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Excess Stormwater Management Work Plan
J.H. Baxter Arlington Facility
Administrative Order on Consent
Docket No. RCRA-10-2001-0086

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Prepared for
J.H. Baxter and
EPA Region 10

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EXCESS STORMWATER MANAGEMENT WORK PLAN J.H. BAXTER ARLINGTON FACILITY ADMINISTRATIVE ORDER ON CONSENT DOCKET NO. RCRA-10-2001-0086

INTRODUCTION

This document presents the Excess Stormwater Management Work Plan for the J.H. Baxter (Baxter) wood preserving facility in Arlington, Washington. This Work Plan is intended to fulfill the requirements set forth in Paragraphs 12.a. and 50 of the U.S. EPA Administrative Order of Consent (AOC) (EPA 2001).

The purpose of the Excess Stormwater Management Work Plan (ESMWP) is to formulate and implement a plan for temporary management of excess stormwater. Excess stormwater is defined by the AOC (Paragraph 7.j.) as stormwater collected by Baxter to prevent overflow from any ditch or swale at the facility. The overall goal is to prevent on-site flooding from impacting site operations and to prevent any off-site migration of stormwater discharges.

This Work Plan outlines the tasks planned to design and implement an Excess Stormwater Management System. This plan develops a concept for the collection, treatment, monitoring, and discharge of excess stormwater with PCP concentrations no greater than 1 μg/L. The plan is organized as follows:

- **Stormwater Quality Assessment.** Summarizes detected constituent concentrations which provides a framework for design of the stormwater management system.

- **Technical Approach to ESMS Design.** Reviews the detailed requirements of the AOC, summarizes and recommends Best Management Practices (BMPs) and treatment technologies for use in Excess Stormwater Management.

- **Excess Stormwater Management System.** Describes the proposed Excess Stormwater Management System (ESMS), including design criteria and a summary of design work remaining.

- **ESMS Operation, Maintenance, and Monitoring Plan.** Describes the operation, maintenance, and monitoring that will be conducted as part of the ESMS.

- **Schedule and Reporting.** Describes the schedule for stormwater management through construction of the final treatment system and provides the contents of the Excess Stormwater Management Report to be submitted under the AOC.

- Appendices A and B presents a Sampling and Analysis Plan and Quality Assurance Project Plan (QAPP), respectively, for data collection activities planned during this work.

- Appendix C provides a review of Baxter's implementation of Best Management Practices (BMPs) applicable to wood treating facilities.

- Appendix D provides a copy of Hart Crowser's memo to Baxter regarding bench-scale polymer performance test results.

Facility Description

The Baxter wood preserving facility is a 52-acre pole processing and wood treatment plant. The site lies just southwest of the intersection of 67th Avenue NE and NE 188th Street in a largely industrial area, 1/4 mile east of the Arlington airport (See Figure 1). The facility lies about a mile southwest of the downtown Arlington area.

The Baxter property consists of three parcels (Figure 2). Parcel A is about 15 acres and occupies the northern part of the site. Treated wood storage and the main treatment plants are located on Parcel A. Parcel B lies to the south of Parcel A and is roughly 30 acres in area. Untreated wood poles are stored and peeled on Parcel B. The third parcel, a closed, wood waste landfill occupies the remaining property just west of the south half of Parcel A.

The Baxter property was largely farmland until the mid- to late 1960s when Ted Butcher Inc. developed a pole peeling and later, a wood treating facility on Parcel A. Historical photographs indicate Mr. Butcher originally conducted log peeling operations on the site, then began treatment operations in the late 1960s. Baxter purchased Parcel A from Ted Butcher in 1970 and began wood treating operations in 1971 (AGI 1997). Baxter also purchased Parcel B in 1970 for use as untreated pole storage. Prior to 1970, Parcel B was agricultural land.

Baxter imports raw logs and processes them into pressure-treated utility poles. The process includes debarking, trimming, marking, seasoning, and treatment. The poles are shipped to utilities and other users by truck or rail line. The treatment process uses a solution of 5 to 6 percent pentachlorophenol (PCP) dissolved in aromatic oil. Previously, Baxter used creosote for pressure treatment in one of its retorts; however, its use was discontinued in 1990.

Hydrologic Setting

The site is located within the northeastern quadrant of a broad, flat glacial outwash plain located between Arlington and Marysville. The outwash is comprised of sands and gravels that drain readily, leaving few natural surface water drainage features. Because of the high permeability of the native soils, the majority of the precipitation in the area infiltrates and becomes part of the groundwater system. The groundwater in the area flows largely to the north to the Portage Creek Valley (USGS 1997). Groundwater is used as a drinking water source.

The closest surface water drainage system originates in the till-capped upland that lies east of the Baxter facility as shown on Figure 1. This drainage lies within the northernmost extent of the Quilceda Creek watershed. Runoff from this upland area east of the facility, which includes a large housing development, is channeled underneath 67th Avenue NE to a drainage ditch that runs parallel to the BNSF railroad. The drainage ditch crosses under the railroad to the Baxter property line adjacent the southern portion of Parcel A. The ditch then flows south parallel to the Baxter property, to a series of ditches that eventually drain into Quilceda Creek, about 2 miles south of the Baxter facility.

Site Stormwater Management

Infiltration has always been the primary means of stormwater control at the relatively flat Baxter facility. As the operational activities have decreased the natural permeability of the surface soils, Baxter has managed stormwater using a system of ditches and french drains that facilitate infiltration. The french drains were largely installed in 1991, although several drains have been added or improved since the initial installation. In the Spring of 2000, the french drains in Parcel A were closed per a Washington State Department of Ecology Order (Ecology 2000b). Figure 2 identifies the locations of the stormwater control ditches, and current and former french drains.

The site is divided into three drainage basins to correspond to the facility's activities and current stormwater management practices (Figure 2). These drainage basins include the Treated Pole Storage Area, the Main Treatment Area, and the Untreated Pole Storage Area. Boundary ditches or berms typically control precipitation that does not naturally infiltrate within these areas. A summary of runoff control within each of these drainage basins is presented below.

- Within the Treated Pole Storage Area, the Treated Pole Storage Area Ditch (see Figure 2) that lies along the western boundary of the storage area controls stormwater runoff. This ditch extends east-west along the south and north boundaries of the Treated Pole Storage Area.

- Within the Main Treatment Area, stormwater runoff west of the retorts is collected within the Main Treatment Area Ditch (see Figure 2). Some of the runoff in the area south of the retorts, also flows south to the low ground around the former french drain 26. Runoff east of the retorts flows to the south to the low ground area around the former drain 25. Drainage to the location of the former french drains 13 and 14 historically discharged via a buried culvert to the south end of the Treated Pole Storage Area Ditch.

- In the Untreated Pole Storage Area stormwater infiltration is enhanced by a series of French drains that have been constructed around the boundaries of this area. Berms have also been constructed along the south and west boundaries of the untreated pole yard to contain any potential off-site discharge. Stormwater typically ponds in the southwest corner of this area as this is the low point of the site. Groundwater levels are estimated to be within 5 feet of ground surface in this area during the wet season based on groundwater level monitoring data from MW-4. High groundwater levels may exacerbate wet season drainage in this area.

Since the site is unpaved, stormwater runoff has high concentrations of suspended solids. These fine-grained materials settle out during infiltration; reducing the permeability of the ditches, french drains, and any area low areas where stormwater puddles.

STORMWATER QUALITY ASSESSMENT

Stormwater discharge was permitted in 1994 by the Washington State Department of Ecology (Ecology) under NPDES Permit No. WA–003 142-9. The permit required stormwater quality sampling and analysis throughout the wet season (September through May) at the each of the french drain locations in Parcel A, and from a composite sample of stormwater at the french drains in the Untreated Pole Storage Area. Under the permit, groundwater quality was also monitored quarterly in eight monitoring wells (BXS-1 through BXS-4, and MW-1 through MW-4).

As a part of the permit renewal in 1998, concerns were identified about surface water and groundwater quality. In 1999, Baxter entered into an Agreed Order with Ecology's Toxics Cleanup Program to address concerns including groundwater quality northwest of the Main Treatment Area. In the Spring of 2000, Ecology's Water Quality Program ordered the french drains in the Main Treatment Area and Treated Pole Storage Area to be closed (Ecology 2000b). A new permit for stormwater was issued in April 2000 (State Waste Discharge Permit No. ST-7425) that called for more discrete sampling of the french drains in the Untreated Pole Storage Area. It was also agreed as part of this permit that lysimeters would be used to monitor the quality of surface water infiltration beneath the ditches within the Main Treatment Area and Treated Pole Storage Areas.

The following sections provide a summary of the surface water data collected as part of this monitoring program. These data are used to assess the occurrence of detected contaminants and provide a framework for evaluating an appropriate approach for the design of an Excess Stormwater Management System.

Stormwater Quality Data

Stormwater samples collected under the facility's NPDES permit have been analyzed for chlorinated phenols (especially PCP), oil and grease, total suspended solids (TSS), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and dioxins. A statistical summary of the stormwater sample chemical analysis results is provided in Table 1. A complete data listing of stormwater samples was included in the Existing Analytical Data memorandum (Hart Crowser 2001). Figure 3 presents a graphical summary of the stormwater sample chemical analysis results collected through January 2001 at each sampling location.

Pentachlorophenol (PCP)

PCP is the principal chemical detected in site stormwater. PCP concentrations in stormwater are significantly higher in the Main Treatment and Treated Pole Storage Areas than in the Untreated Pole Storage Area. The average PCP concentration in the treated wood storage area is 291 µg/L with a range of 0.8 to 960 µg/L. The average PCP concentration in the Untreated Pole Storage Area is 27 µg/L with a range of 0.7 to 73 µg/L.

PCP concentrations have historically been highest in locations of the former drains 23 and 24 within the Treated Pole Storage Area Ditch and the Main Treatment Area Ditch, respectively. PCP concentrations detected at the former drains 23 and 24, averaged about twice the concentrations detected at drains 13, 14, and 25. Figure 4 presents a trend analysis of PCP concentrations for the surface water data from the Main Treatment Area and Treated Pole Storage

Area. These data indicate a decreasing concentration over the period of sampling for the Main Treatment Area and Treated Pole Storage Area drains with the exception of the former drains 13 and 14 (note that drains 13/14 discharged directly to the Treated Pole Storage Area Ditch in which drain 23 was located and not into a drainfield). Improved stormwater management practices, improved sampling techniques, and/or lower turbidity levels could be factors contributing to this trend.

PCP concentrations in the Untreated Pole Storage Area are one to two orders of magnitude (10 to 100 times) lower than those detected in the Main Treatment and Treated Pole Storage Areas. Until the most recent sampling events, samples collected from the Untreated Pole Storage Area were composites of up to twelve drains. Under the new State Waste Discharge Permit, a more discrete sampling has been conducted, but not to the degree required to draw conclusions about spatial distribution in the untreated area.

The stormwater samples are generally very turbid, with average total suspended solids (TSS) concentrations ranging between 564 mg/L for the Main Treatment and Treated Pole Storage Areas, and 2,020 mg/L for the Untreated Pole Storage Area. Because of the high turbidity of the samples and the affinity of PCP for adsorption onto soil particles, the detected PCP concentrations are unlikely to represent true dissolved PCP concentrations. Estimates of the dissolved PCP concentration were made for the stormwater in the Main Treatment and Treated Pole Storage Area that indicated roughly 50 percent of the detected concentrations may be dissolved PCP (Hart Crowser 2000a).

In addition, two rounds of lysimeter sampling and analysis were conducted in 2001 to assess the concentrations of dissolved PCP that may be infiltrating in the stormwater ditches in the Main Treatment Area and the Treated Pole Storage Area. PCP was detected in only one of the six samples collected. PCP was detected at a concentration of 27 μg/L in lysimeter L1 located near former catch basin 24. The non-detects and low concentration of PCP in samples collected from the lysimeters indicate PCP is associated with suspended solids and much of the dissolved fraction that infiltrates through the surface soil sorbs onto soil particles or biodegrades before reaching the groundwater table.

Dioxins

Selected stormwater samples have been analyzed for dioxin/furans since 1997. The dioxin concentrations in stormwater samples vary widely. Dioxin concentrations in unfiltered samples range between 48 and 1,189 pg/L (Total Toxic Equivalent Quotient [TEQ]) in the Untreated Pole Storage Area stormwater, and between 0.26 and 9,969 pg/L (Total TEQ) in the Main

Treatment and Treated Poles Storage Areas stormwater. Considering the strongly hydrophobic nature of these compounds, it is likely that these data are not representative of true dissolved dioxin concentrations. Dioxin concentrations detected in filtered samples collected on Parcel A range from below detection limits to 424 pg/L, indicating that most of the dioxins in surface water are likely associated with particulates.

Other Chemical Constituents

Oil and grease are occasionally detected in site stormwater samples at relatively low concentrations. Two samples of 121 analyzed exceeded the NPDES permit level of 10 mg/L in the Main Treatment and Treated Pole Storage Areas and two samples of 33 exceeded the permit level in the Untreated Pole Storage Area.

PAHs are also occasionally detected at low concentrations in site stormwater samples. Isolated detections in samples collected in Parcels A and B have total PAH concentrations ranging from 0.2 to 34 ug/L.

Potential Sources of PCP in Stormwater

In general, the potential sources of PCP to stormwater are associated with areas where wood treatment operations and treated pole storage have occurred. Wood treating chemicals have not been used or stored on Parcel B. PCP may have been transported from Parcel A to Parcel B—particularly in the past—via vehicle traffic and equipment crossover, through air releases, or via stormwater. Currently there is a distinct hydraulic divide between the Main Treatment Area and Untreated Pole Storage Area, and runoff from the swale area near former drains 25 and 26 has not been observed to flow any further into Parcel B. Further analysis and study of potential sources of PCP (and other chemicals) to stormwater will be conducted as part of the Facility Site Investigation.

TECHNICAL APPROACH TO ESMS DESIGN

The stormwater quality assessment provides a framework for evaluating best management practices (BMPs) and stormwater collection and treatment methodologies that will reduce potential stormwater impacts from PCP. PCP is the primary constituent of concern in stormwater and occurs in highest concentrations in the Main Treatment and Treated Pole Storage Areas. The sources of stormwater contamination have changed over time as BMPs have been implemented and what appears to remain as the principal source of PCP to stormwater is residual levels of PCP in surface soils. The extent of residual levels of PCP in surface soils will be assessed as part of the facility's site investigation.

The technical approach to management of excess stormwater will be to continue to implement BMPs and to focus on collection and treatment of excess stormwater in the Main Treatment and Treated Pole Storage Areas. In these areas are the facility's stormwater ditches and swales, which have the potential to overflow and potentially flood operations (because drains were closed per Ecology's order [2000b]). Flooding in these areas could worsen any environmental impact being caused by PCP in the stormwater.

This section develops a technical approach for controlling PCP-contaminated stormwater in the Main Treatment and Treated Pole Storage Areas. The technical approach includes identifying the specific requirements of each of the regulations cited in the AOC, summarizing BMP implementation and identifying additional BMPs, and finally by screening treatment technologies for achieving the treatment goal of PCP no greater than 1 μg/L.

Regardless of the BMPs and treatment technologies selected, implementation of the ESMS will require design, construction, and startup phases prior to operation of the system. The Work Breakdown Structure presented in Table 3 shows the phases of implementation. The specific tasks identified in Table 3 are discussed in detail in the Excess Stormwater Management System section and Sampling and Analysis Plan (Appendix A).

AOC Requirements

Under Paragraph 50.a of the AOC, the Excess Stormwater Management System (ESMS) must comply with the following requirements:

i. The regulations at 40 C.F.R. Part 265, Subpart J and Subpart I, except §§ 265.197(c) and 265.200 and the provisions of § 265.192 to the extent that they require reviews, inspections, and/or certifications by an independent qualified professional engineer or an independent qualified installation inspector that these same reviews, inspections, and/or certifications are performed by Respondent's staff or consultants who are qualified, registered professional engineers or, where and as allowed by the provisions of § 265.192, qualified installation inspectors.

ii. Clearly mark and make visible for inspection the date upon which each period of accumulation begins on each container and tank;

Paving the site to reduce the suspended solids was considered and recommended by AGI's AKART analysis (1997); however, paving the site is extremely costly (up to 5.5 million dollars depending on the area paved) and is likely to conflict with potential soil and groundwater remedial actions. Paving the site is being considered for long-term remedial action and stormwater control, but is not practical until corrective action measures have been determined.

AGI identified and screened twelve stormwater treatment process options for stormwater from the Main Treatment and Treated Pole Storage Areas (AGI 1997). Although AGI's screening scenarios do not match the conditions imposed by the AOC, much of the analysis and conclusions still apply. The screening presented here updates AGI's conclusions to reflect the requirements of the AOC and include new treatment technologies.

Screening of Treatment Technologies

Table 4 evaluates the ability of treatment technologies at removing TSS and PCP to achieve the threshold of 1 µg/L. Sixteen treatment technologies were screened for application both in the ESMS and a future final treatment system. The screening criteria used were effectiveness at contaminant removal, implementability, and cost. Separate technologies were selected for TSS and PCP removal. The technologies will operate in series.

Recommended Treatment Technologies

Solids Removal

Polymer-enhanced settling was selected as the TSS removal technology for the ESMS, because of its easy implementation and effectiveness at removing TSS. One weakness of polymer-enhanced settling is that too high a polymer dose could result in excess polymer in the settling tank effluent, which could clog the activated carbon units. A treatability test was conducted to confirm the effectiveness of polymer-enhanced settling as a TSS removal technology for the site (Hart Crowser 2000b). The treatability test also identified an optimal polymer (Catfloc 2953) and dose (50 ppm).

Detention and filtration were both eliminated as TSS removal technologies. Detention was eliminated because removal of fine TSS particles would require a long settling time and thus large detention volume. Also, Ecology requires that no surface impoundments of contaminated stormwater be constructed on the site (Ecology 2000b). Filtration was eliminated because of the intensive maintenance required for filters to remove the high TSS load. Also, the small particle size of site TSS would require very fine filters, which would increase clogging.

Two other TSS removal technologies, sand filters and bioswales, will be retained for consideration during design of the final system. The final system may include multiple TSS removal technologies such as a bioswale followed by a sand filter.

PCP Removal

Activated carbon was selected as the most demonstrated technology for removal of PCP. Activated carbon has a long history of success in reducing PCP concentrations to non-detectable concentrations. Activated carbon is currently used on site to treat process water prior to evaporation. Baxter has also had success treating stormwater with activated carbon at its Eugene facility. Activated carbon units are readily available in rental skid-mounted units. Although expensive, activated carbon is the most likely technology to achieve the 1 µg/L AOC requirement.

Many of the technologies were not well-suited for use in an interim system. The biotreatment technologies (e.g., activated sludge or rotating biological contactors) require high organics concentrations (ppm levels) to provide effective treatment. Chemical oxidation, absorbent resins, and ion exchange resins have exorbitant costs or are simply not feasible at an interim scale.

Three media filtration technologies (surface modified zeolite (SMZ), organoclay, and leaf compost) are promising cost efficient options for PCP removal. However, the success of these media in removing PCP is not as well documented as activated carbon. These media will be considered for inclusion in the treatability test to be conducted during operation of the ESMS.

EXCESS STORMWATER MANAGEMENT SYSTEM

This section describes the design objectives, conceptual design (preliminary design criteria), and preliminary system layout and description of the Excess Stormwater Management System (ESMS) for the J.H. Baxter Arlington plant. The conceptual design is based on the BMPs and treatment technologies selected as discussed in the Technical Approach to ESMS Design section. Data sufficiency and proposed activities for filling data gaps for completing the design of the ESMS and Future Final Treatment System are discussed at the end of this section.

Design Objectives

The primary functions of the ESMS are to:

- Collect excess stormwater to:
  - Prevent stormwater from migrating off site;
  - Prevent stormwater from impacting the operation of the facility; and
  - Control overflow from ditches and swales.
- Treat stormwater to less than 1 µg/L PCP prior to discharge.
- Ensure that all stormwater tanks, pipes, and treatment units are enclosed in secondary containment structures to prevent the release of untreated stormwater.
- Collect data on pilot-scale treatability (media filtration) and field-scale performance (solids generation, carbon usage rates, infiltration rates) for use in design of a final stormwater treatment system.

Conceptual Design

This section presents the preliminary layout and design criteria of the ESMS. Final design of the system will be completed after approval of this work plan. The main components of the ESMS will consist of the following:

- One or more pump stations for collecting excess stormwater;
- One influent storage/equalization tank for holding excess stormwater prior to treatment;
- Polymer-enhanced settling in a weir tank or inclined-plate clarifier for solids removal;
- Granular activated carbon (GAC) for PCP removal;
- Three effluent storage tanks for holding and initially testing treated stormwater prior to discharge; and
- Discharge of treated stormwater to one or more infiltration facilities.

Preliminary design criteria for the ESMS are presented in Table 5. These criteria are based on our current understanding of the site, appropriate design guidance, and regulatory requirements. The hydrologic and treatability design analyses of the system are discussed below.

Hydrologic Analysis

Current site hydrology was evaluated with a custom, time-series model based on the 52-year precipitation record at the Arlington Municipal Airport. The model was developed to simulate the ponding and infiltration of stormwater through multiple precipitation events with the goal of identifying the required storage and treatment system capacity. The model is basically a water balance with runoff predicted by the rational method and infiltration simulated with fixed, conservatively low infiltration rates for the ditches and Treated Pole Storage Area. Soil moisture and its impacts on infiltration rate, evapotranspiration, and the impact of settled solids on infiltration rates were not simulated.

The model resulted in the conclusion that a required storage of 105,000 gallons and a treatment system flow rate of 50 gpm were adequate for an interim system. The model was originally developed for a simpler treatment system then the ESMS, so these results are not directly applicable but do provide a basis of understanding. The ESMS has a larger scope (intended discharge location, contributing area, etc.) than the modeled system. Additional hydrologic analyses will be performed (Hydrologic Assessment, Table 3, Subtask 2.4) prior to finalizing the design of the ESMS.

The following preliminary criteria have been estimated based on current understanding of site conditions and extreme precipitation events:

- Pump station flow rate and influent storage tank volume will be designed to collect and contain the 10-year 24-hour storm from the Main Treatment Area. The existing surface storage volume of ditches and swales of Parcel A, as determined by the topographic survey, will be subtracted from the 10-year 24-hour storm volume to determine the required influent storage tank volume. We anticipate a required storage tank volume of 250,000 gallons. The pump station flow rate to collect this volume within a 24-hour period would be 175 gpm.

- The treatment system flow rate will be designed based on the volume of required storage and the desired length of time to treat that volume. The treatment system will be capable of treating the entire stored volume within seven days, assuming a 12-hour per day operating shift. We anticipate that the design treatment system flow rate will be 50 gpm.

- Design infiltration rates will be determined during the infiltration testing described in the Data Sufficiency for Design section. The infiltration system will have a capacity equal to the design treatment system flow rate, 50 gpm. The infiltration system will be designed in general accordance with the Ecology Stormwater Management Manual (1992), Snohomish County Addendum (1998), and site-specific infiltration data. Based on an AGI's assumed infiltration rate of 0.75 inch per hour (AGI 1997), the interim treatment system would require 2,200 feet of 3-foot-wide trench to achieve an infiltration capacity of 50 gpm.

Polymer-Enhanced Settling

The optimal polymer and polymer dose were determined through a bench-scale polymer treatability test (see results in Appendix D). As part of this test, eight polymers and polymer combinations were evaluated. CatFLOC 2953 at a dose of 50 parts per million (ppm) was determined to be the optimal polymer based on performance and cost. A combination of CatFLOC 2953 at 50 ppm and NALCLEAR at 20 ppm produced the best settling results. However, settling with CatFLOC alone was sufficient to meet site needs and avoids the extra cost of additional polymer makedown (e.g., dilution/mixing) and injection systems.

Design of the interim treatment system will incorporate injection of CatFLOC 2953 at an initial dose of 50 ppm. If additional settling is determined to be necessary during operation of the interim system, NALCLEAR will be added at 20 ppm. Polymer doses may be altered based on field observations.

Settling will occur within a weir tank with multiple overflow weirs. At a flow rate of 50 gpm, a 21,000-gallon weir tank provides a retention time of 7 hours.

If the required system flow rate exceeds 75 gpm, an inclined plate clarifier would be considered rather than the weir tank.

Granular Activated Carbon Adsorption

The GAC system will be sized to achieve an effluent PCP concentration of no greater than 1 µg/L at the required system flow rate. The system will be sized using vendor models of carbon usage rates based on PCP adsorption isotherms. The grade of activated carbon will be selected to minimize the volume of spent carbon generated.

Preliminary System Location

The proposed location of the overall system is shown on Figure 5. Excess stormwater would initially be collected in the vicinity of former drain 26. Additional collection points would be added if needed to meet the design objectives. The stormwater storage tanks and treatment system would be located near the kilns south of the Main Treatment Area. We have identified three potential infiltration areas for the treated stormwater, as shown on Figure 5. The final infiltration area location for the ESMS will be selected after completing the Subsurface Infiltration Testing (Subtask 2.3) and Hydrologic Assessment (Subtask 2.4) as outlined in Table 3, and is subject to EPA approval. The proposed locations of the individual treatment units are shown on Figure 6. The layout of the stormwater treatment system will include adequate space and influent/effluent connections for pilot-scale media filtration test units.

System Description

Stormwater Collection

A pump station would be installed at the location of former drain 26. This location accumulates water from the south treatment area. A culvert would be installed between former drain 26 and the ditch along the west side of the treatment area. After completion of the culvert and implementation of BMP S8a (Improved Runoff and Collection Facilities), the former drain 26 area would capable of collecting stormwater from the entire Main Treatment Area.

The collection pump would consist of a submersible sump pump capable of producing 50 gpm (72,000 gpd) at a total dynamic head of approximately 15 feet. The collection pump would be installed on a support frame to prevent entrainment of sediments. Double walled piping with a leak detection system would be installed underground, crossing under the railroad tracks from the ditch to the influent storage tank.

If necessary to meet the design objectives, the existing pump at drain 25 would be used as a second collection pump discharging directly to the influent storage tank.

Influent Storage Tank

One 250,000-gallon influent storage tank would be installed to contain excess stormwater in the Main Treatment Area. The temporary, field-erected tank would have secondary containment and could be readily moved to other locations, if necessary for the final stormwater management system.

Treatment

The treatment system would reduce the PCP concentration in stormwater to below the treatment standard of 1 µg/L by adsorption with GAC. To achieve this level of treatment, the treatment system would include a solids removal process, consisting of polymer-enhanced settling. This description of the treatment system is based on a design flow of 50 gpm. If the design flow rate is revised the components of the treatment system will be adjusted accordingly.

Polymer-Enhanced Settling

Solids removal would consist of polymer-enhanced settling in a 21,000-gallon weir tank. Without polymer addition, the weir tank is designed to remove solids larger than 40 microns at a flow rate of 50 gpm or less. According to AGI's grain size analysis of ditch sediment, 90 percent of the suspended particles are smaller than 40 microns. Removal of these smaller particles will require polymer-enhanced settling. CATFLOC 2953 at 50 ppm was the most efficient polymer and dose determined in the bench-scale treatability study (Hart Crowser 2000b).

Polymer addition would require a chemical metering pump, static mixer, and a polymer makedown system. CATFLOC 2953 would be shipped as a liquid directly from the supplier in 55-gallon drums and would require mixing and dilution prior to being added to the treatment system. Once mixed, the polymer would be injected by the chemical metering pump into a static mixer upstream of the weir tank. The static mixer is a baffled section of pipe that creates turbulence to mix the stormwater and polymer. The stormwater and polymer then enter the weir tank where flocculation and settling would occur.

Activated Carbon

Two Calgon Carbon Cyclesorb FP-2 activated carbon adsorption units in series would be used to remove PCP from the excess stormwater. The FP-2 is a 6-foot-diameter pressurized skid-mounted canister containing 2,000 pounds of GAC. Based on an influent PCP concentration of 300 µg/L and adsorption isotherm modeling performed by Calgon Carbon, 0.7 pound of carbon would be used per day of treatment at a flow rate of 50 gpm. The expected pressure drop would be less than 14 psi at a flow rate of 50 gpm. The Cyclesorb system can treat up to 60 gpm. In the event that the design flow rate is greater than 60 gpm, a second set of FP-2 units would be added in parallel or a larger sized unit would be used.

Effluent Storage Tanks

Effluent storage is required during the initial batch operation of the treatment plant. Three existing 16,000-gallon tanks will provide effluent storage during the startup/batch operation of the stormwater treatment system. At the end of batch operations, the effluent storage tanks will continue to be used as a source of backwash water for the activated carbon, if needed.

Discharge of Treated Stormwater

Treated stormwater meeting the 1 µg/L concentration will be discharged on site pending an Ecology "contained-in determination" as discussed in the Operations and Maintenance-Waste Management Practices section of this document. If treated stormwater does not meet this criterion during batch operations at startup, it would be re-circulated through the treatment system or stored until more advanced treatment can be added to the system.

Treated stormwater would be discharged through above- and below-grade piping into an engineered infiltration system. The infiltration system would be installed at a location selected to minimize the impact of infiltrated water on the existing groundwater contaminant plume. The three most probable infiltration locations are shown on Figure 5. The infiltration system location for the ESMS will be selected after completing the Subsurface Infiltration Testing (Subtask 2.3) and Hydrologic Assessment (Subtask 2.4) in Appendix A.

Solids Handling

The treatment system would generate solids at a rate of approximately 3.5 to 7 cubic yards (depending on TSS concentration) per 100,000 gallons of stormwater treated. This estimated solids generation rate assumes an influent TSS concentration of 400 to 700 mg/L and a solids content of 5 percent. The solids will accumulate in the weir tank, which has a slanted floor and bottom draining valves to allow for solids removal.

Based on the estimated solids generation rate and the expected excess stormwater volumes requiring treatment, it would not be practical or cost-effective to install a dewatering system at the site. Instead a mobile dewatering unit (e.g., a truck-mounted centrifuge) will be brought to the site under a service contract to dewater solids as needed. Supernatant from the dewatering process will be returned to the influent storage tank for treatment. Dewatered solids will be managed as discussed in the Operations and Maintenance-Waste Management Practices section of this document.

Data Sufficiency for Design

This section evaluates the sufficiency of design data for the ESMS and future stormwater treatment system. Where insufficient data are currently available for design, additional investigation steps are proposed to collect the needed information.

As mentioned above, there are hydrologic uncertainties that must be addressed prior to completing the design of the ESMS. There are also uncertainties regarding the quality and treatability of stormwater at the site. Seven years of stormwater monitoring data are available for the site. These data provide a relatively good understanding of the range of expected contaminant concentrations. No additional stormwater quality or treatability data collection is proposed prior to design and construction of the ESMS. However, data collected during ESMS operations, ongoing compliance monitoring, and the Site Investigation will address the remaining questions about the quality and treatability of stormwater at the site.

Insufficient data are currently available in the following areas:

- Hydrologic conditions at the site, including drainage and Infiltration;
- Innovative Filtration Treatability of Stormwater;
- Partitioning of PCP between dissolved and particulate phases; and
- Spatial variation of PCP concentrations in the Untreated Pole Storage Area.

Hydrologic Conditions

Additional information about site hydrology is required for design of the ESMS. No measured infiltration rate data are available for site surface or subsurface soils and surface drainage patterns on the flat site are currently described by an outdated survey. The following work items are required for design of the ESMS.

Hydrologic Field Survey. A field survey conducted during or after an extreme precipitation event is required to document site drainage patterns. The field survey will identify whether and where flow might occur from the Main Treatment Area to the Untreated Pole Storage Area. Additionally, the field survey will confirm and document the presence of hydraulic control at the property boundaries. If any areas are identified that require additional hydraulic controls, this work will be performed during implementation of BMP A15.

Topographic Survey. A recent topographic survey is required to define hydraulic gradients, identify low spots, and determine existing grade for construction of the ESMS. The scope of the survey will include a boundary survey, topographic survey of the entire site (including the wood waste landfill), and topographic survey of the railroad ditch.

Surface and Subsurface Infiltration Testing. A better understanding of surface and subsurface infiltration rates is necessary for two reasons: to refine our hydrologic model to more accurately predict the occurrence of excess stormwater, and to design the infiltration system. This task includes performing double-ring infiltrometer testing (ASTM D 3385-94) of surface soils in ditches, within the Treated and Untreated Pole Storage Areas, and of subsurface soils at the proposed locations for the infiltration system. As an additional check on infiltration rates, staff gages will be installed in ditches at several locations. Site personnel will read staff gages on a daily basis during the wet season.

This hydrologic investigation work will be coordinated with the surface water investigation that will be proposed in the Site Investigation Work Plan. Hydrologic investigation data collected under this plan will be used, as appropriate, for the Site Investigation Work Plan.

Innovative Filtration Treatability of Stormwater

Several innovative filtration media may be more effective than GAC in removing PCP from stormwater. Alternatively, an innovative filtration media may be useful as a pre-treatment method prior to GAC. The ESMS will be used to conduct bench- and pilot-scale treatability tests of the innovative media identified in the previous section to assess if one of these media should be included in a final stormwater management system. The details of the Filtration Treatability Test are presented in the Sampling and Analysis Plan in Appendix A.

Briefly, a sample of effluent from the weir tank will be collected for bench-scale treatability testing with up to three innovative filtration media. We anticipate performing bench-scale testing on the following media: surface modified zeolite, organoclay, and leaf compost or another media to be determined later. The best performing media based on bench-scale testing will be selected for a pilot-scale treatability test. If no media performs favorably during bench-scale testing, pilot-scale testing will not be performed. The pilot-scale treatability test will consist of routing 5 to 15 gpm from the clarifier effluent through a chamber containing the test media. Effluent from the test media will be routed to the activated carbon to assure full treatment. Influent and effluent samples will be collected to assess the performance of the media.

Partitioning of PCP between Dissolved and Particulate Phases

The partitioning of PCP between dissolved and particulate phases in site stormwater is not well-defined particularly in the Untreated Pole Storage Area. The RI indicated that the dissolved concentration is expected to be between 70 and 200 µg/L, with the remaining PCP absorbed to particles (Hart Crowser 2000a). Additional information about the partitioning of PCP will be determined during operation of the ESMS from collection of filtered and unfiltered samples of influent, and evaluation polymer-enhanced settling performance. Data collected during ESMS operations, ongoing compliance monitoring, and the Site Investigation will address the remaining questions about the relationship between TSS and PCP.

Spatial Variation of PCP Concentrations in the Untreated Pole Storage Area

To date, stormwater samples collected in the Untreated Pole Storage Area have been for the most part composites from multiple locations. Composite samples result in an accurate characterization of average concentrations; however, they do not identify areas of higher concentration which could help identify sources in Untreated Pole Storage Area. Collection of discrete samples at the drains at several locations in the Untreated Pole Storage Area would aid in identifying sources. Discrete sampling of stormwater at the drains in the Untreated Pole Storage Area is being conducted as a requirement of the State Waste Discharge Permit. These samples will identify locations of higher concentrations. Further investigation in the Untreated Pole Storage Area will be included in the Site Investigation Work Plan.

ESMS OPERATIONS, MAINTENANCE, AND MONITORING PLAN

Operations and Maintenance

The ESMS will require careful operations and maintenance (O&M) to ensure proper performance. During startup, the system will be operated as a batch system, with effluent samples collected from each batch. After completion of startup, the system will be operated in a continuous mode, as needed.

During startup, batches of at least 10,000 gallons of stormwater will be collected and treated. Treated batches will be held in the effluent storage tanks pending favorable laboratory results. Batches with PCP concentrations no greater than 1 µg/L will be discharged. If the PCP concentration in any batch of stormwater is greater than 1 µg/L, the batch will be returned to the influent storage tank and undergo additional treatment. After successful treatment of three batches of stormwater in a row, operation of the treatment system will switch to a continuous mode.

During the continuous mode of operation, stormwater will be collected, treated, and discharged on an as needed basis. Effluent samples will be collected monthly to ensure that the treatment system complies with the AOC's PCP effluent limit. If the PCP concentration in any effluent sample exceeds 1 µg/L, the system will return to batch operations until two successive batches have been effectively treated.

The large volume of the influent storage tanks allows stormwater collection and treatment to operate independently. Stormwater collection will occur at any time day or night as needed to collect excess stormwater. Treatment will occur generally during weekday day shifts (up to 12 hours per day). Both collection and treatment operations will be manually operated, with high- and low-level shutoffs as appropriate for safe operations.

Generally, Baxter employees are on site 24 hours a day, seven days a week throughout the year. Should Baxter reduce its working hours, float switches will be added to automate the collection pump. The treatment system will only be operated manually.

The system may require the following maintenance to be performed during the first year of operations: exchange of polymer drums, removal of accumulated solids from weir tank, and replacement of activated carbon unit. The treatment system will be shutdown during any major maintenance event.

Employee Training

Baxter currently has Spill Response, Hazardous Waste Handling, Hazardous Communication, and Stormwater Pollution Prevention training programs that cover the majority of issues associated with operation of the ESMS. Additional training in the specifics of operation and maintenance of the ESMS will be provided prior to system startup. The additional training will include:

- System Startup;
- Maintenance;
- System Shutdown; and
- Emergency Procedures and Spill Response.

Multiple employees will be trained in operation of the treatment system to accommodate 24 hours a day operation of the collection pump and 12 hours a day operation of the treatment system, as well as vacation, holidays, and sick leave. Only employees trained in the operation and maintenance of the ESMS will be allowed to operate the system. At least one trained employee must be on site at all times while the system is operating. The treatment system will not be allowed to operate overnight unattended.

Waste Management Practices

During operation of the ESMS, we anticipate management of five waste streams: excess stormwater, solids, spent absorbent media (i.e., carbon), dewatering supernatant and decontamination liquids, and at closure debris (e.g., plastic liners, non-reusable equipment, etc.).

Each of the five waste streams will be managed as F032 hazardous waste until such time as the issues regarding F-listing are resolved as discussed below. Baxter is not aware of any listed hazardous waste sources of PCP to the stormwater. Baxter maintains that stormwater from areas of its plant other than the drip pad is not a hazardous waste based on EPA's guidance on this issue. However, Baxter acknowledges that Region 10 has taken a different position on this matter with regard to stormwater in areas other than the process area at Baxter's Arlington plant. Baxter believes that EPA's interpretation is incorrect; however, this issue is not likely to be resolved prior to this winter when Baxter needs to have the ESMS operational. Therefore, until this issue is resolved Baxter will for the purposes of the ESMS manage the untreated stormwater and related waste streams as F032 waste. If a determination is later made that the stormwater influent does not contain F032 waste, the untreated stormwater and related waste streams will be analyzed for the hazardous waste characteristics and state-only criteria. If designated as hazardous, the wastes will be analyzed for compliance with Land Disposal Restrictions (LDR) (40 CFR 268), then treated and disposed of accordingly.

Excess Stormwater. Excess stormwater will be collected and treated on site in accordance with the AOC. Stormwater influent and effluent tanks will be labeled as "Contains Contaminated Stormwater" in accordance with AOC Paragraph 50.a.iii. Effluent meeting the 1 μg/L concentration will be discharged on site pending an Ecology "contained-in determination." The containers will be marked with the accumulation dates as required by Paragraph 50.a.ii. Tanks containing excess stormwater and the area around them will be inspected each operating day. Daily records of the volume of treated stormwater will be kept using a totalizing flow meter installed in the discharge line. Records will be submitted in the Excess Stormwater Management Report and when requested by EPA.

Solids. Solids removed during polymer-enhanced settling will be managed as a newly generated waste stream in accordance with 40 CFR 262. Solids will be accumulated on site for 90 days or less prior to shipment for off-site disposal. The point of generation for solids will be when solids are removed from the treatment system for dewatering. Dewatered solids will be placed in a lined and covered roll-off container for transportation to the off-site disposal facility. Containers are anticipated to have a capacity of 20 cubic yards; however, other container sizes may be used. Containers will be inspected weekly to ensure no leaks or deterioration.

Records and manifests for hazardous wastes generated by the treatment of excess stormwater will be submitted in the Excess Stormwater Management Report in accordance with Paragraph 50.c of the AOC and when requested by EPA.

Samples will be collected from each batch of solids to be shipped off site to ensure compliance with the LDR for F032 hazardous wastes. Task 5.5 in Appendix A presents details on waste characterization sampling and analysis. Based on surface soil and stormwater concentrations, we anticipate that contaminant concentrations in settled solids will be below the LDR thresholds and thus solids will be disposed of in a Subtitle C landfill. The LDR thresholds are shown in Table 6. If concentrations exceed the thresholds, solids will be incinerated and the residuals disposed of in a Subtitle C landfill.

If at a later date EPA and Baxter concur that the excess stormwater is not F032 waste, solids would be sampled for proper designation per the hazardous waste characteristics and state-only criteria. If the solids are designated as dangerous waste, the solids will be sampled to ensure compliance with LDR and to provide treatability information.

Spent Absorbent Media. Spent absorbent media (spent media) will be generated during ESMS operations and during treatability testing. Spent media is a newly generated waste stream and will be managed in accordance with 40 CFR 262. Aside from the small quantity of spent media generated during bench-scale treatability testing (Task 7 in Appendix A), we anticipate that disposal of spent media will only be required at the end of ESMS operations.

Spent carbon cannot be regenerated as Calgon Carbon will not accept spent activated carbon containing 2,3,7,8-TCDD or designated as F032 waste due to the presence of dioxins as underlying hazardous constituents. The spent media will be sampled (see Task 5.5 in Appendix A) to determine if concentrations exceed the LDR thresholds (Table 6). If concentrations exceed the Land Disposal Restrictions, the spent media will require treatment by incineration prior to Subtitle C disposal so long as the stormwater is considered an F032 listed waste. Baxter may elect to forgo sampling and assume that concentrations exceed the LDR thresholds.

Records and manifests for hazardous wastes generated by the treatment of excess stormwater will be submitted in the Excess Stormwater Management Report in accordance with Paragraph 50.c of the AOC and when requested by EPA.

In the future if EPA and Baxter concur that the stormwater is not F032 listed waste, the spent carbon and any treatability media will be sampled for proper designation per the hazardous waste characteristics and state-only criteria. If the solids are designated as dangerous waste, they will be characterized for compliance with the State Land Disposal Restrictions and either incinerated or disposed of in a Subtitle C landfill according to characterization results.

Liquids. Dewatering supernatant will be returned to the influent storage tank to be treated with the ESMS. The volume of liquid returned to the ESMS will not be tracked separately from the volume of excess stormwater treated. Decontamination wastes are expected to consist of Alconox wash water and rinseate. Decontamination wastes will be treated by Baxter's existing on-site process water treatment system.

Debris. Debris generated at closure of the treatment system may include non-reusable treatment system components (e.g., liners, above-ground piping). To comply with LDRs, debris will be decontaminated by water washing and spraying in accordance with the Alternative Treatment Standards for Hazardous Debris in Table 1 of 40 CFR 268.45. Rinseate and washwater generated during decontamination of debris will be treated by Baxter's existing on-site process water treatment system. After decontamination, debris will no longer be a hazardous waste and will be disposed of at a non-hazardous solid waste landfill.

Monitoring

This section summarizes the monitoring plan for collection of compliance and process control samples. A detailed monitoring plan is included in Appendix A. The corresponding Quality Assurance Project Plan (QAPP) is included in Appendix B.

Monitoring conducted during Excess Stormwater Management includes the following tasks:

- Sample Effluent at Treatment System Startup - Three Batches;

- Sample Effluent during Continuous Operation of Treatment System -one Sample Monthly, or Every 14 Discharge Days;

- Collect Process Control Samples during Continuous Operation -as needed, to confirm system performance;

- Collect Waste Characterization Samples; and

- Collect Samples during Bench- and Pilot-Scale Treatability Tests.

Reporting, Tracking, and Recordkeeping

Accurate tracking of the operation and maintenance of the ESMS is important for verifying compliance with the AOC and generating useful information for design of the final treatment system. The following records will be maintained as a component of Excess Stormwater Management:

- Tank assessment and installation inspection.

- Daily Operations and Maintenance Records including:

  - Treatment system periods of operation;

  - Tank water levels;

  - Volume of stormwater treated;

  - Maintenance performed;

  - Polymer usage; and

  - Daily tank inspection.

- Field Sampling Records.

- Sample Chain of Custody.

- Secondary Containment Inspections.

- Waste Disposal Records.
  - Hazardous Waste Manifests; and
  - Certificates of Disposal.

- Water Levels in the Ditches.

SCHEDULE AND REPORTING

Proposed Schedule for Implementation of ESMS

A schedule of all work proposed in this Work Plan is presented in Table 3. The schedule for design, construction, and startup of the ESMS is governed by the potential need to manage excess stormwater from fall 2001 through spring 2002.

Design of the ESMS is scheduled to begin upon EPA review and approval of this Work Plan and will be completed with 45 days. Construction will require less than 60 days and will be completed in mid-September in time for startup and troubleshooting prior to the heavier rains typically beginning in November. Bench-scale treatability tests will be conducted during the first three months of operation ending in December 2001. Pilot-scale testing, if warranted, will be performed in January and February of 2002. Pilot-scale testing will be performed at Baxter's option, and will only be performed if bench-scale testing yields favorable results. Results of the treatability tests will be reported as data become available and analyses are completed. Results will be transmitted as Technical Memoranda with the Monthly Progress Report. The Excess Stormwater Management report will be submitted within 60 days of completion of the Corrective Measures Implementation Plan as required by the AOC.

Proposed Excess Stormwater Management Report Outline

The AOC requires that the Excess Stormwater Management Report be submitted within 60 days after EPA approval of the Corrective Measures Implementation Plan. We propose the following outline for the Excess Stormwater Management report:

1.0 Introduction
2.0 As-Built Interim System Description
3.0 Operations and Maintenance (O&M)
    3.1 Summary of Stormwater Events
    3.2 Compliance Sampling Results
    3.3 Maintenance Performed
    3.4 Waste Designation and Handling
4.0 Treatability Test Results
5.0 Data Evaluation/Implications for Final System Design
6.0 Proposed Final System Design

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Table 1 - Statistical Summary of Analytical Results for Stormwater Samples

Analyte	Detection Frequency	Range	Maximum Detection	Location and Date of Maximum Detect.		Average (detects only)
Main Treatment and Treated Wood Storage Areas						
Dioxins in pg/L						
2378-TCDD	4/19	0.566 U to 110	110	Drains 13-14	6/24/98	48.2
Total TEQ (WHO 1998)	17/17	0.2677 to 9969	9969	Drains 13-14	1/8/98	2512
Semivolatiles in µg/L						
Total PAHs	34/106	0.1 to 84.8 U	34.1	Drains 13-14	1/1/97	3.939
Total cPAHs	25/41	0.1 to 8.1	8.1	Drain 13	3/11/98	1.865
Conventionals in mg/L						
Total Suspended Solids	120/124	5 to 3140	3140	Drain 25	11/1/94	564.47
pH	124/124	6.01 to 8.82	8.82	Drain 25	5/1/97	7.30
Chlorinated Phenols in µg/L						
2,4,6-Trichlorophenol	0/41	0.5 U to 50 U	N/A			4.29
Pentachlorophenol	124/124	0.8 to 960	960	Drain 24	1/1/96	291.02
Total Tetrachlorophenols	31/41	0.5 U to 50 U	15	Drain 24;	1/21/99;	7.37
				Drains 13-14	1/21/99	7.37
TPH in mg/L						
Oil and Grease	86/121	1 to 16	16	Drain 25	9/1/94	3.60
Untreated Wood Storage Area						
Dioxins in pg/L						
2378-TCDD	8/13	0.456 U to 16	16	Drain 18	1/19/01	8.98
Total TEQ (WHO 1998)	13/13	48.285 to 1189	1189	Drain 18	1/19/01	526.87
Semivolatiles in µg/L						
Total PAHs	7/18	0.1 to 6.2 U	0.4	Drains 10-22	3/1/97	0.25
Total cPAHs	4/8	0.1 to 0.2 U	0.11	Drains 10-22	3/28/00	0.10
Conventionals in mg/L						
Total Suspended Solids	32/33	5 U to 19900	19900	Drains 10-22	3/1/95	2020
pH	33/33	5.95 to 8.22	8.22	Drains 10-22	11/17/98	7.13
Chlorinated Phenols in µg/L						
2,4,6-Trichlorophenol	0/8	0.5 U to 5 U	N/A			0.66
Pentachlorophenol	33/33	0.74 to 73	73	Drains 10-22	12/1/95	27.06
Total Tetrachlorophenols	5/8	0.86 to 5 U	2.7	Drains 10-22	9/18/97	1.89
TPH in mg/L						
Oil and Grease	17/33	1 to 13	13	Drains 10-22;	1/8/98;	4.76

Notes:

U = Not detected at indicated detection limit.

Total TEQ (WHO 1998) was calculated using detected dioxin results multiplied by the corresponding WHO 1998 Toxic Equivalency Factor.

Table 2 - Regulatory Requirements of RCRA Section 7003 Order

Paragraph	Citation	Subject	Requirement	Implementation
50.a.i	40 CFR Subpart J §265.192(a), (b), and (g)	Tank Systems	New Tanks Systems - PE must certify written assessment of tank integrity and appropriateness for given waste. Tank installation expert or PE inspect tank installation. Records kept on site.	Tank assessments will be obtained and certified. Tank installation will be inspected prior to use. No underground tanks will be used.
	40 CFR §265.192(c)	Tank Systems	Underground tanks or piping must have good backfill that provides uniform support.	No underground tanks are planned. Underground piping will be appropriately backfilled.
	40 CFR §265.192(d)	Tank Systems	Testing for tightness must be conducted prior to use.	Tanks will be tested to ensure tightness prior to use.
	40 CFR §265.192(e)	Tank Systems	Support ancillary equipment against damage from settlement, vibration or expansion/contraction.	Ancillary equipment will be supported as needed.
	40 CFR §265.192(f)	Tank Systems	Owner must provide corrosion protection as determined necessary during tank assessment.	Corrosion protection is not anticipated to be required. However, if necessary it will be provided.
	40 CFR §265.193(a), and (b)	Tank Systems	Secondary Containment and Leak Detection - Provide secondary containment for all new tank systems and ancillary equipment. Containment system must prevent migration and be capable of detecting and collecting releases.	Secondary containment will be lined berms and/or double-walled tanks. Leak detection will be visual inspection for tanks in lined berm and a dip tube between the walls for double-walled tanks.
	40 CFR §265.193(c)	Tank Systems	Secondary containment must be compatible with waste stored, and have a solid foundation and leak detection system. Spills must be removed within 24 hours.	Secondary containment will be designed to comply. Spills will be removed within 24 hours or less.
	40 CFR §265.193(d), and (e)	Tank Systems	Secondary containment must be: a liner, vault, double-walled tank, or as approved. Each system has specific requirements in (e). Liners and vaults require 100% of the largest tank volume and prevention or containment of 25-year; 24-hour run-on.	Lined berms will be sized to contain 100% of largest tank volume and direct precipitation from the 25-year 24-hour event. Berms will prevent stormwater run-on.
	40 CFR §265.193(f)	Tank Systems	Ancillary equipment must have secondary containment except for above-ground piping.	Secondary containment will be provided for below ground piping (e.g., double-walled pipe) and other ancillary equipment.

Table 2 - Regulatory Requirements of RCRA Section 7003 Order

Paragraph	Citation	Subject	Requirement	Implementation
50.a.i	40 CFR §265.194	Tank Systems	Operating Requirements - No wastes may be placed in tanks that could cause failure or damage. Spill prevention practices must be used.	Contaminated stormwater will not cause damage or failure of tanks. Spill prevention practices, including secondary containment, will be implemented where appropriate.
	40 CFR §265.195	Tank Systems	Inspections - Inspections during each operating day of above-ground tanks, leak detection data, and area around tank.	Tanks and area around tanks will be inspected each operating day.
	40 CFR §265.196	Tank Systems	Response to Spills or Leaks - If a tank or secondary containment system leaks owner must stop use, empty the tank, and report releases to the environment. Tank system must remain closed until repairs are made.	Requirements will be included in a supplement to the existing site spill and contingency plan.
	40 CFR §265.197 (except 265.197(c))	Tank Systems	Closure and Post-Closure Care - At closure, all contaminated equipment, liners, soils, or residues must be managed (removal or decontamination) as a hazardous waste.	Tank system closure will include decontamination of tanks and proper designation and disposal of residues.
	40 CFR §265.198	Tank Systems	Ignitable and Reactive Wastes must not be stored in tanks.	Contaminated stormwater is not an ignitable or reactive waste.
	40 CFR §265.199	Tank Systems	Incompatible Wastes cannot be stored in the same tank.	Contaminated stormwater will not be stored in tanks with incompatible wastes.
	40 CFR Part 265 Subpart I	Containers	Containers holding hazardous waste must be in good condition, compatible with waste being held, and always closed. Weekly inspections required.	Containers might be used for shipment of stormwater off-site for treatability testing, or shipment of waste for off-site disposal. Containers used will comply with Subpart I and will be inspected weekly while stored on site.
50.a.ii		Labeling	Clearly mark and make visible for inspection the date upon which each period of accumulation begins on each container and tank.	Influent and effluent storage tanks and any RCRA regulated sludge or other byproduct storage tanks will be so marked. The weir tank and activated carbon systems are flow-through process tanks and do not have accumulation dates and will not be labeled.

Table 2 - Regulatory Requirements of RCRA Section 7003 Order

Paragraph	Citation	Subject	Requirement	Implementation
50.a.iii		Labeling	Clearly label or mark each container and tank used to accumulate the Excess Stormwater with the words "Contains Contaminated Stormwater."	The influent tank will be so marked.
50.a.iv	40 CFR Part 265 Subpart C	Preparedness and Prevention	Maintain facility to minimize possibility of fire, explosion, or unplanned release of hazardous materials.	Component of existing plant operations. No modifications needed.
	40 CFR §265.32, 265.33 and 265.34	Preparedness and Prevention	Facility must provide, test, and maintain the following equipment: internal alarm system, telephone or radio, fire extinguishers, spill control and decontamination equipment, and sufficient water or foam for fire suppression.	Component of existing plant operations. No modifications needed.
	40 CFR §265.35	Preparedness and Prevention	Maintain aisle space to allow emergency access to all areas of facility.	Design of treatment system will not obstruct aisleways.
	40 CFR §265.37	Preparedness and Prevention	Facility must make arrangements as appropriate with police, fire, emergency response teams, and local hospitals to familiarize with hazardous waste operations.	Arrangements have been made as component of existing contingency plan.
	40 CFR Part 265 Subpart D	Contingency Plan	Facility must have a contingency plan to minimize risk of fires, explosions, and release of hazardous waste.	Existing spill and contingency plan will be supplemented to include spill prevention and emergency procedures associated with the treatment system. Emergency coordinator has been designated in the existing plan and will not change. Risk of fire, explosion, or other emergency associated with the treatment system is minimal.
	40 CFR §265.55, and §265.56	Contingency Plan	Emergency coordinator must be present on site or on call at all times. Emergency coordinator must follow the emergency procedures outlined in 265.56 including sounding alarms and notifying state and local officials.	Emergency coordinator is designated in the spill and contingency plan. No changes are necessary.

Table 2 - Regulatory Requirements of RCRA Section 7003 Order

Paragraph	Citation	Subject	Requirement	Implementation
50.a.iv	40 CFR §265.16(a)	Personnel Training	Personnel must complete training in hazardous waste management and emergency procedures.	Baxter's existing Spill Response, Hazardous Waste Handling, Hazardous Communication, and Stormwater Pollution Prevention training programs meet the general requirements of §265.16. Additional training other than the specifics of operation and maintenance of the treatment system will be not be required.
	40 CFR §265.16(b), and (c)	Personnel Training	Training completed within six months and reviewed annually.	Met by existing training program. Additional training will be conducted prior to startup of treatment system.
	40 CFR §265.16(d), and (e)	Personnel Training	Facility must maintain records of training. Records kept until facility closure or three years after employee departure.	Met by existing training program.
	40 CFR §268.7(a)(4)	Generator Paperwork Requirements	For exempt wastes, generator must provide a one-time written notice to disposal facilities receiving waste. Notice shall include: 1. EPA Hazardous Waste Numbers and Manifest Number; 2. "This waste is not prohibited from land disposal"; 3. Waste analysis data (when available); 4. Date the waste is subject to the prohibition; and 5. For hazardous debris treated according to §268.45: contaminants being treated and indication of treatment to comply. (Line numbers from Generator Paperwork Requirements Table)	Does not apply at this time.
50.a.v		Treatment	Treat the Excess Stormwater to no greater than 1 µg/L PCP prior to discharge.	Excess stormwater will be treated with polymer-enhanced settling and activated carbon remove PCP.

Table 2 - Regulatory Requirements of RCRA Section 7003 Order

Paragraph	Citation	Subject	Requirement	Implementation
50.a.vi		Discharge	Analysis to confirm that Excess Stormwater has been treated to no greater than 1 µg/L PCP before discharge.	Treatment system will be operated as a batch system until successful treatment of 3 batches (16,000 gallons each) from separate storm events, then operation will switch to semi-continuous. During batch operations treated effluent will not be discharged until laboratory confirmation that PCP concentrations are no greater than 1 µg/L. During continuous operations, effluent samples will be collected at least once per month to confirm performance.
50.a.vii		Discharge	Discharge treated Excess Stormwater in a location and manner least likely to impact the existing contaminated groundwater plume or, in the alternative, disposal off site.	Treated stormwater will be discharged to an infiltration facility located in one of the three areas shown on Figure 5. Discharge to the surface water ditch near the railroad on the east will be considered during ESMS design phase but is not likely to be feasible due to time required for permitting completion of a biological assessment to address ESA issues related to the Quilceda Creek Salmon Recovery Plan; and the limited capacity of the ditch and downstream flooding.

Table 3 - Work Breakdown Structure and Schedule

TASK	SUBTASK	SCHEDULE
1.0 Work Plan	1.1 Conduct Stormwater Quality Assessment 1.2 Conduct Regulatory and Technology Assessment 1.3 Develop Preliminary Basis of Design and Description for Excess Stormwater Management System (ESMS) 1.4 Develop Operation and Monitoring Plan for ESMS 1.5 Develop Schedule for Design, Implementation, and Monitoring of ESMS 1.6 Develop Excess Stormwater Management Report Outline	Submit Work Plan to EPA, May 30, 2001
2.0 Design and Construction Permitting	2.1 Conduct Topographic Drainage Survey 2.2 Conduct Surface Infiltration Test 2.3 Conduct Subsurface Infiltration Test 2.4 Conduct Hydrologic Assessment 2.5 Conduct Polymer-Enhanced Treatability Test (Completed) 2.6 Finalize Design Drawings for ESMS. 2.7 Obtain Construction Permits	Complete Task 2 45 days after EPA Approval of Work Plan
3.0 Procurement and Installation	3.1 Procure Equipment 3.2 Site Preparation and Containment for Storage Tank and Stormwater Treatment Area 3.3 Grading to Ensure Hydraulic Separation of Parcels A and B 3.4 Installation of Stormwater Collection System 3.5 Installation of Storage Tank 3.6 Installation of Treatment System 3.7 Installation of Infiltration System 3.8 Conduct Installation Compliance Inspection 3.9 Prepare As-Built Drawings	Complete Task 3 60 days after Completion of Design
4.0 Startup and Initial Operation	4.1 Conduct System Startup 4.2 Conduct Operator Training 4.3 Conduct Batch Operations 4.4 Conduct Monitoring of Batch Operations	Complete Task 4 after testing three batches of treated stormwater
5.0 Operations and Monitoring	5.1 Conduct Interim Operations (As Needed) 5.2 Conduct Effluent Compliance Monitoring 5.3 Conduct Hydrologic Confirmation Inspection and Monitoring 5.4 Conduct Treatment Process Performance Monitoring 5.5 Conduct Waste Characterization Sampling 5.6 Conduct Reporting, Tracking and Recordkeeping	Continue Task 5 until Final Stormwater Management System comes online.

Table 3 - Work Breakdown Structure and Schedule

Task	Subtask	Schedule
6.0 Treatability Testing for Final Stormwater Remedy	6.1 Conduct Bench-Scale Filtration Treatability Test 6.2 Conduct Pilot-Scale Filtration Treatability Test	Conduct Task 6 during representative storm events
7.0 Excess Stormwater Management Report		Submit Report to EPA 60 days after EPA approval of the CMI Plan

Table 4 - Screening of Stormwater Treatment Technologies

Constituent	Process Option	Effectiveness	Implementability	Cost	Screening
TSS	Detention	Fines require high detention time	EPA desires and Ecology requires no surface impoundments; large area	Inexpensive	Eliminated
	Filtration	Good but very fine filter required	Skid-mounted but high O&M	Moderate	Eliminated
	Polymer-Enhanced Settling	**Good but polymer carryover could clog downstream filtration**	**Skid-mounted systems available**	**Inexpensive**	**Implement for ESMS**
	Sand Filter	Excellent but clogging from fines	Skid-mounted systems available	Expensive	Retain for full-scale
	Biofiltration Swale	Poor for fines, vegetation provides some organics uptake	Requires large area and time for vegetation growth	Inexpensive	Retain for full-scale
PCP	Chemical Oxidation/UV	Unlikely to achieve 1 ppb	Not feasible on interim scale	Not costed	Eliminated
	Activated Sludge	Biotreatment requires high influent PCP (above 1 ppm)	Not feasible on interim scale	Not costed	Eliminated
	Fixed-Film System	Biotreatment requires high influent PCP (above 1 ppm)	Not feasible on interim scale	Not costed	Eliminated
	Fluidized Bed System	Biotreatment requires high influent PCP (above 1 ppm)	Not feasible on interim scale	Not costed	Eliminated
	Rotating Biological Contactor	Biotreatment requires high influent PCP (above 1 ppm)	Not feasible on interim scale	Not costed	Eliminated
	Granular Activated Carbon	**Likely to achieve 1 ppb**	**Skid-mounted systems available**	**Moderate**	**Implement for ESMS**
	Absorbent Resins	Probably can achieve 1 ppb	Not feasible on interim scale	Expensive	Eliminated
	Ion Exchange Resins	Poor without modifying pH	Not feasible on interim scale	Expensive	Eliminated
	Surface Modified Zeolite	Uncertain for PCP	Moderate - Requires custom skid	Less than GAC	Treatability Test
	Organoclay	Uncertain for PCP	Moderate - Requires custom skid	Less than GAC	Treatability Test
	Leaf Compost	Uncertain for PCP	Moderate - Requires custom skid	Less than GAC	Treatability Test

Notes:
Analysis based on AGI's AKART Study (1997) and updated for new site treatment thresholds.

Table 5 - Preliminary Design Criteria for Excess Stormwater Management System

System Component	Design Objective	Design Criteria	Value	Unit
Stormwater Collection	Collect Excess Stormwater to: • Prevent off-site migration; • Prevent impact to facility operations; and • Control overflow from ditches and swales.	Design Storm - Return Period - Duration	 10 24	 Year Hour
		No. Pump Stations	1	--
		Pumping Rate	175	gpm
		Pumping Duration	24	Hour
Influent Storage	Store Excess Stormwater from design storm to allow reduced treatment system size.	Percentage Stored	100	%
		No. Tanks	1	--
		Volume	250,000	Gallon
Influent Pumping	Pump stored Excess Stormwater from design storm to treatment system.	Duration of Pumping	7	Day
		Daily Operation	12	Hour
		No. Pumps	1	--
		Pumping Rate	50	gpm
Polymer-Enhanced Settling	Remove total suspended solids (TSS) to allow for effective PCP removal through GAC adsorption.	TSS Concentration - Average Influent - Removal	 600 95	 mg/L %
		Flow Rate	50	gpm
		Min. Settling Time	4	Hour
		Settling Tank Volume	21,000	Gallon
		Polymer	Catfloc 2953	--
		Polymer Dose	50	ppm
Activated Carbon	Remove PCP as specified in the Order.	PCP Concentration - Average Influent - Req'd Effluent	 300 5	 ug/L ug/L
		Flow Rate	50	gpm
		Min. Residence Time	30	Minute
		No. Units	2	--
		Operation Mode	Series	--
		Media Weight per Unit	2,000	Lb
Effluent Storage	Store treated stormwater prior to discharge for batch testing during startup; provide for GAC backwash water, if needed.	Duration of Treatment per Batch	4	Hour
		No. Tanks/Batches	3	--
		Volume per Tank	16,000	Gallon

Table 5 - Preliminary Design Criteria for Excess Stormwater Management System

System Component	Design Objective	Design Criteria	Value	Unit
Discharge and Infiltration of Treated Stormwater	Infiltrate treated stormwater to: • Prevent impact to existing groundwater plume; • Match treatment flow rate; and • Comply with Ecology Stormwater Manual.	Discharge Rate	50	gpm
		Infiltration Rate	To be measured	--
		Infiltration Area	To be determined	--

Table 6 - Land Disposal Restriction Thresholds for F032 Hazardous Waste (40 CFR 268.40)

REGULATED HAZARDOUS CONSTITUENT		WASTEWATERS	NON WASTEWATERS
Common Name	CAS Number	Concentration in mg/L	Concentration in mg/kg unless noted as "mg/L TCLP"
Acenaphthene	83-32-9	0.059	3.4
Anthracene	120-12-7	0.059	3.4
Benz(a)anthracene	56-55-3	0.059	3.4
Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene)	205-99-2	0.11	6.8
Benzo(k)fluoranthene (difficult to distinguish from benzo(b)fluoranthene)	207-08-9	0.11	6.8
Benzo(a)pyrene	50-32-8	0.061	3.4
Chrysene	218-01-9	0.059	3.4
Dibenz(a,h)anthracene	53-70-3	0.055	8.2
2-4 Dimethyl phenol	105-67-9	0.036	14
Fluorene	86-73-7	0.059	3.4
Hexachlorodibenzo-p-dioxins	NA	0.000063, or CMBST	0.001, or CMBST
Hexachlorodibenzofurans	NA	0.000063, or CMBST	0.001, or CMBST
Indeno (1,2,3-c,d) pyrene	193-39-5	0.0055	3.4
Naphthalene	91-20-3	0.059	5.6
Pentachlorodibenzo-p-dioxins	NA	0.000063, or CMBST	0.001, or CMBST
Pentachlorodibenzofurans	NA	0.000035, or CMBST	0.001, or CMBST
Pentachlorophenol	87-86-5	0.089	7.4
Phenanthrene	85-01-8	0.059	5.6
Phenol	108-95-2	0.039	6.2
Pyrene	129-00-0	0.067	8.2
Tetrachlorodibenzo-p-dioxins	NA	0.000063, or CMBST	0.001, or CMBST
Tetrachlorodibenzofurans	NA	0.000063, or CMBST	0.001, or CMBST
2,3,4,6-Tetrachlorophenol	58-90-2	0.03	7.4
2,4,6-Trichlorophenol	88-06-2	0.035	7.4
Arsenic	7440-38-2	1.4	5.0 mg/L TCLP
Chromium(Total)	7440-47-3	2.77	0.60 mg/L TCLP

Notes:

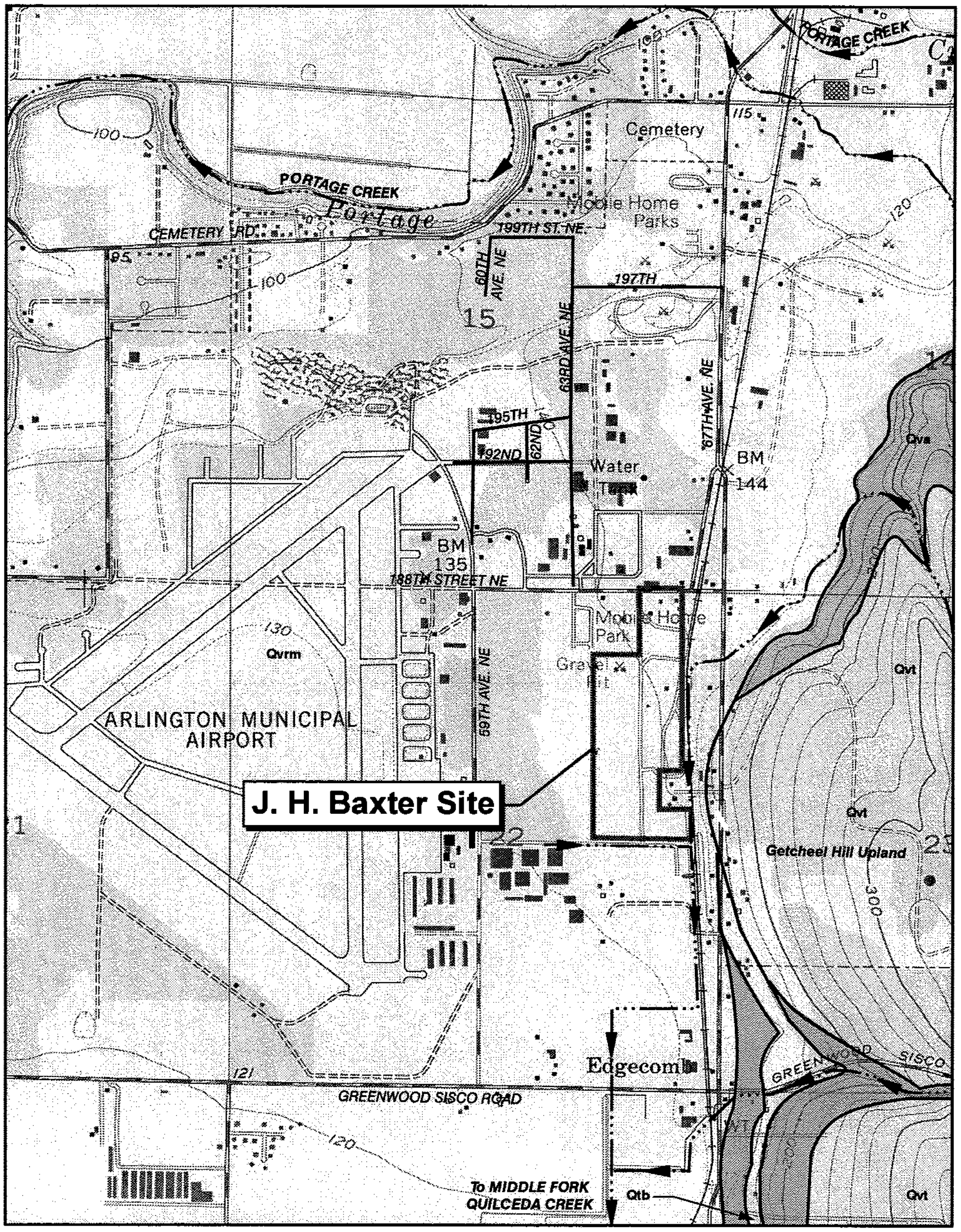
CAS - Chemical Abstract Services.

CMBST - High temperature organic destruction such as combustion in incinerators.

NA - Not Applicable.

TCLP - Toxicity Characteristic Leaching Procedure.

Vicinity Map



DTN 702605AA.cdr 5/29/01

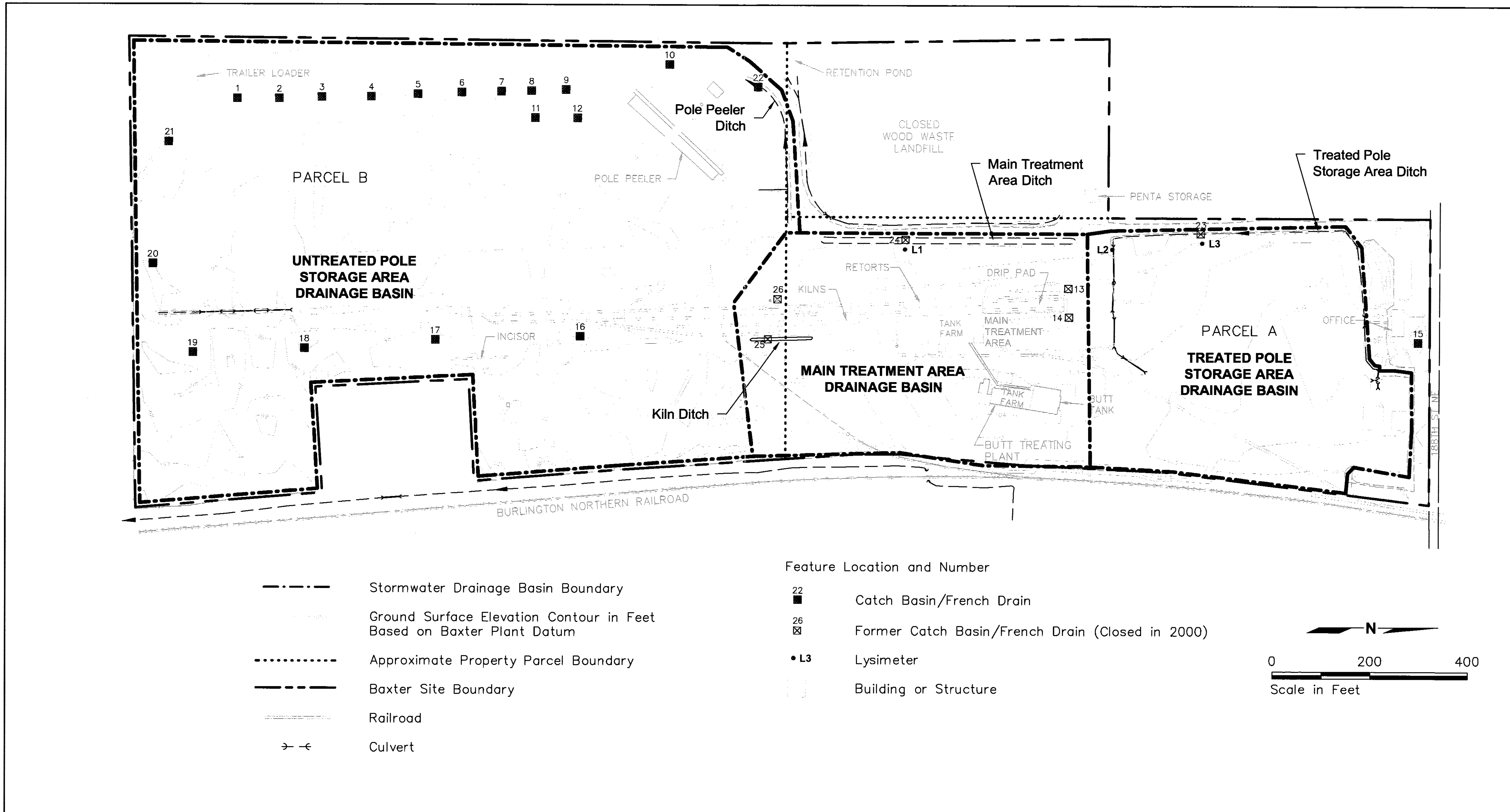
Note:
Base map prepared from USGS 7.5 minute quadrangle map of Arlington West, Washington, dated 1981. Township 31N, Range 5E.

——···——► Surface Water Flow Direction

0 2000 4000
Scale in Feet

HARTCROWSER
J-7026-05 *5/01*
Figure 1

Site Drainage Basin Map



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Note: Base map prepared from survey by Clark Leeman Land Surveying, October 1995.

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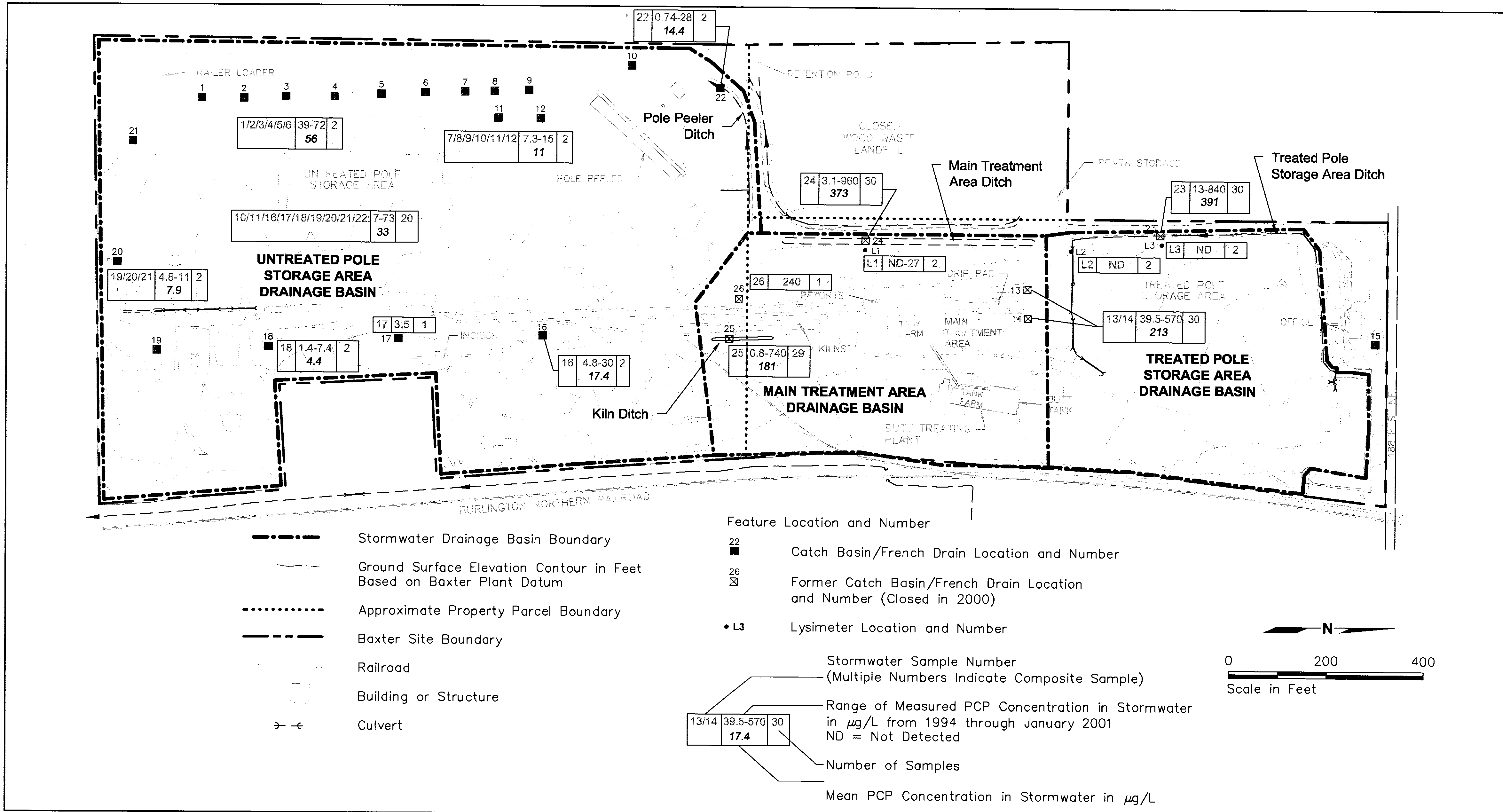
7026-05 5/01

Figure 2

PCP Concentrations in Stormwater



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Note: Base map based on survey by Clark Leeman Land Surveying, October 1995.

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Figure 3

PCP and TSS Concentrations with Time

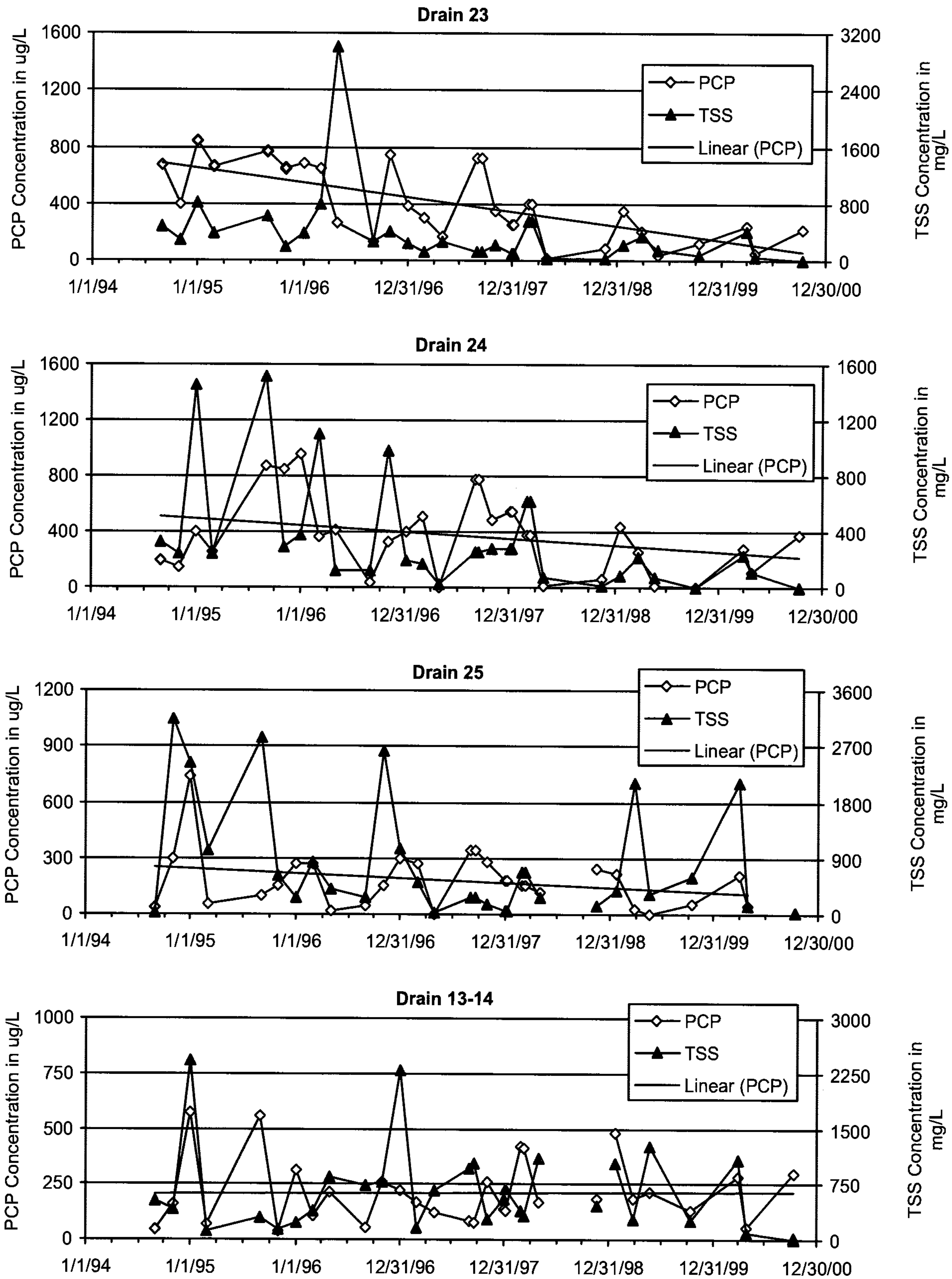

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Figure 4

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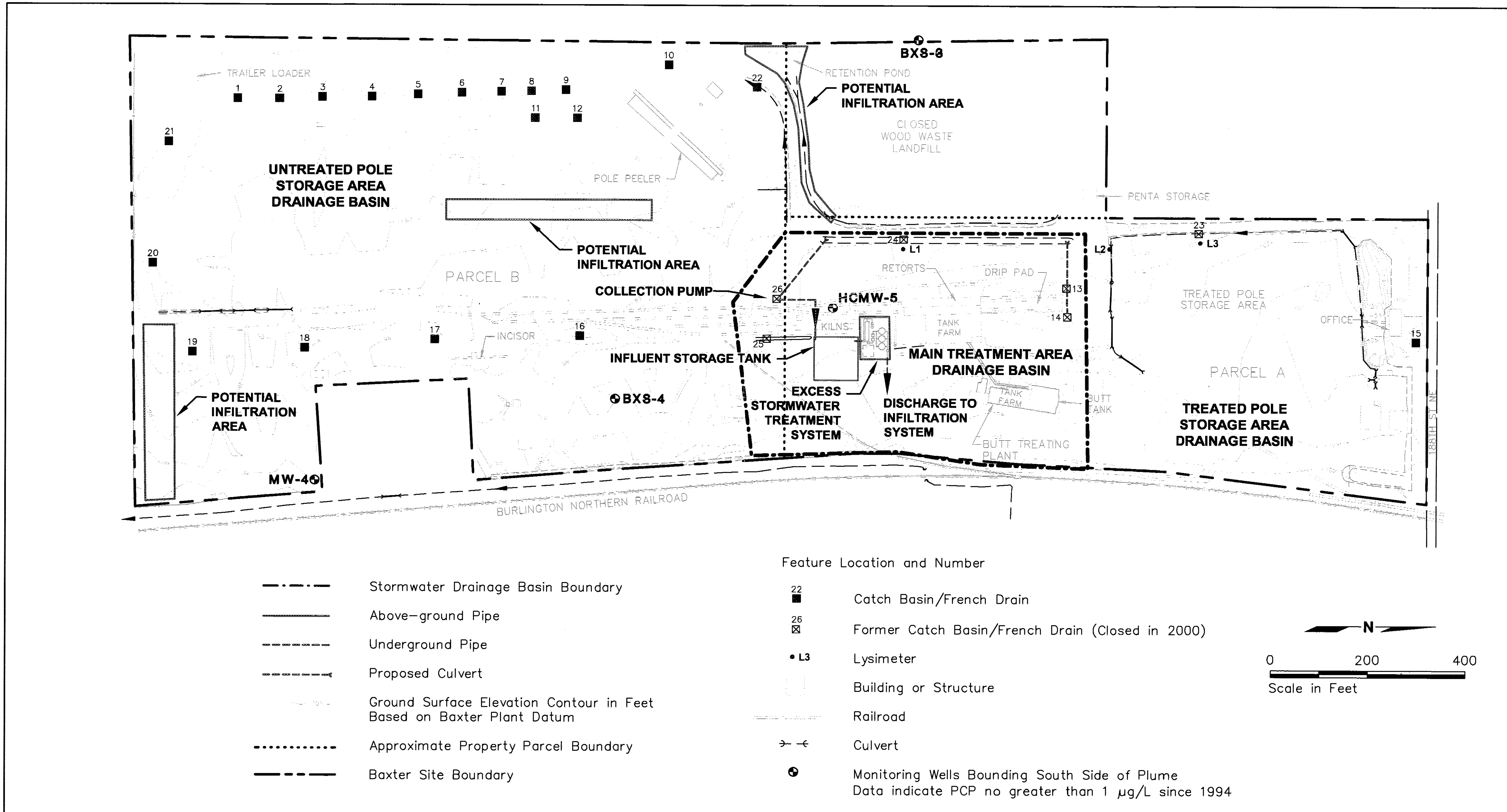
Excess Stormwater Management System Layout



70260507B dwl 1:200

Note: Base map prepared from survey by Clark Leeman Land Surveying, October 1995.

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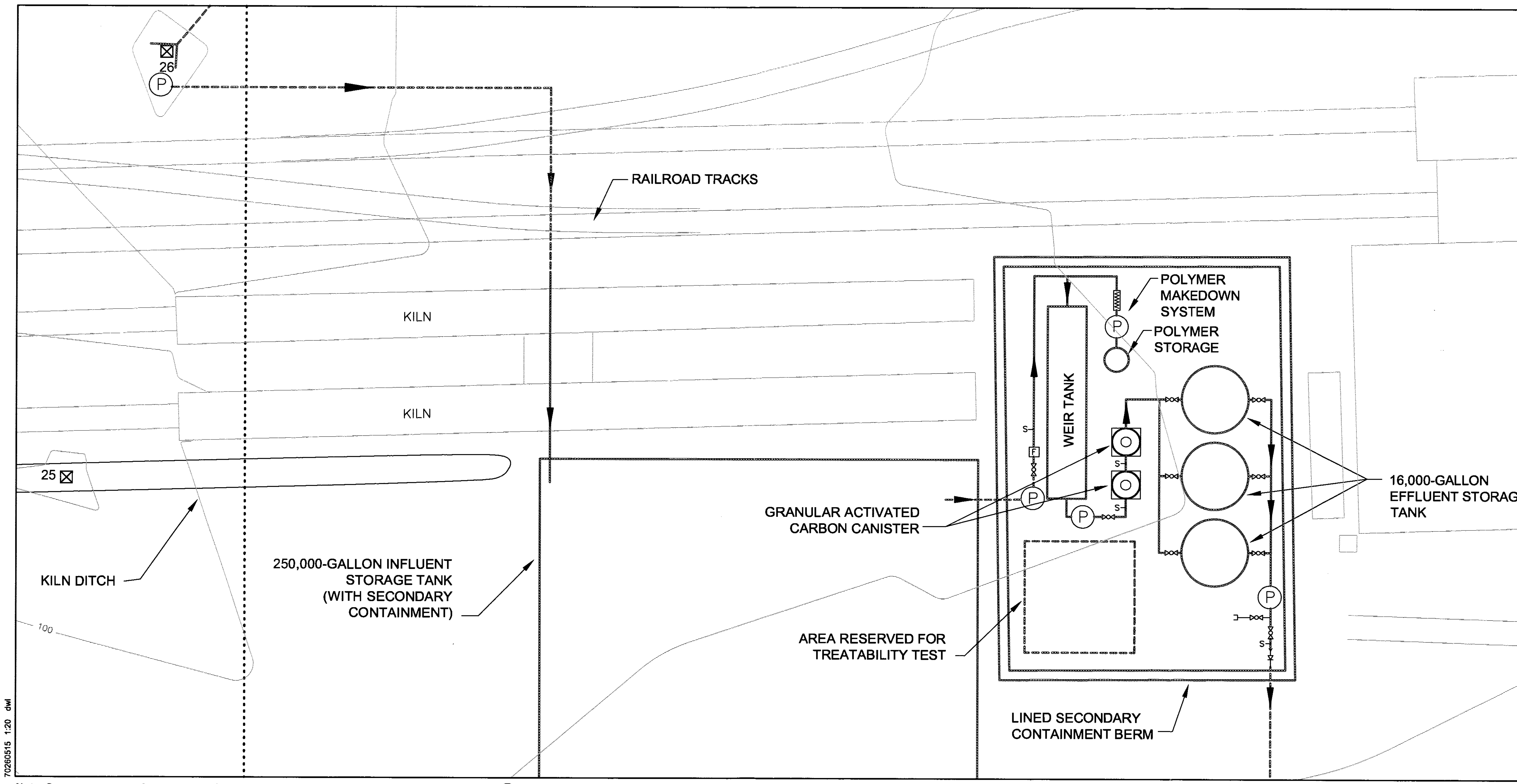
7026-05 6/01

Figure 5

Excess Stormwater Management System Detail



Note: Base map prepared from survey by Clark Leeman Land Surveying, October 1995.

P	Pump		Check Valve
	Above Ground Pipe	F	Flow Meter
	Under Ground Pipe	S	Sampling Port
	Ball Valve		Quick-Connect Coupling
	Static Mixer	• • • • •	Approximate Property Parcel Boundary
25 ⊠	Catch Basin Location and Number		Proposed Culvert

N

0 20 40

Scale in Feet

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7026-05 5/01

Figure 6

APPENDIX A
SAMPLING AND ANALYSIS PLAN

APPENDIX A
SAMPLING AND ANALYSIS PLAN

This Sampling and Analysis Plan presents the details of the sampling and analysis to be conducted for the design and operation of the Excess Stormwater Management System (ESMS). The Sampling and Analysis Plan includes tasks to be conducted for completion of the system design and tasks that will be conducted during the system operation. Table A-1 provides a summary of monitoring to be performed. Task numbers refer to the work breakdown structure in Table 3.

Investigations for System Design

Tasks 2.2 and 2.3—Perform Surface and Subsurface Infiltration Testing

Infiltration rates will be measured on surface soils at five locations and subsurface soils at up to nine locations. Infiltration testing will be performed at the following locations:

- Bottom of Treated Pole Storage Area Ditch and Main Treatment Area Ditch;
- High vehicle travel area (roadway);
- Treated Pole Storage Yard;
- Untreated Pole Storage Yard; and
- In up to three test pits at each of the proposed infiltration areas as shown on Figure 5. Test pits within each proposed infiltration area will be approximately 200 feet apart.

The purpose of determining surface infiltration rates is to refine the hydrologic model for the site by improving estimates of area wide infiltration and runoff coefficients. The purpose of determining subsurface infiltration rates is to design an infiltration facility to infiltrate ESMS effluent. If a proposed infiltration area is eliminated from consideration for any reason, no infiltration testing will be performed in that area.

Infiltration rates will be measured using a double-ring infiltrometer in accordance with ASTM D 3385-94 (ASTM 1994). Test pits for subsurface infiltration testing will be constructed with a level bottom and a depth between 3 and 4 feet. The rings will be installed manually, or by pushing them into the soil with hydraulic equipment (e.g., backhoe). Infiltration readings will be recorded on the attached infiltration testing form (Attachment A-1) until a relatively constant rate is obtained. Reading interval will vary depending on the conductivity of the soil being tested.

The Data Quality Objective (DQO) is to obtain the best practical estimate of infiltration rates across the site to improve the hydrologic understanding and to assist in design of an infiltration facility for ESMS effluent.

Task 5.3—Monitor Surface Water Hydrology

We will monitor the surface water hydrology of the site by installing staff gages in the Main Treatment Area Ditch and Treated Pole Storage Area Ditch. The purpose of installing staff gages is to monitor water levels in the ditches to determine infiltration rates and to provide planning data for when to operate the ESMS. The water levels and surveyed staff gages will be measured from September to May to confirm infiltration rate estimates from infiltrometer testing (Tasks 2.2 and 2.3).

The staff gages will have a range of at least 5 feet and a minimum increment of no greater than 0.1 foot. Staff gages will be installed by fastening the gage to a pole anchored in the bottom of the ditch. The gages will be installed so that the depth of water in the ditch can be directly read from the gage (i.e., gage reading of 0 feet will correspond to the bottom of the ditch). A point on the staff gage will be surveyed to establish a reference elevation and allow for calculation of the water surface elevation. Water surface elevation calculations will be performed using spreadsheet software to reduce the possibility of errors.

The DQO for monitoring water level in the ditches will be to record water level in each ditch once per day throughout the 9-month wet season. Measurements will be made to an accuracy of at least 0.1 foot, so that an accurate assessment of stormwater infiltration rates and volumes may be made.

Treatment System Operations Monitoring

Task 4.4—Collect Effluent Samples during Startup

During startup we will collect samples from batches of effluent from the ESMS. The treatment system will operate in batch mode, with each batch sampled, until three successive batches have PCP concentrations no greater than 1 μg/L. One grab sample will be collected per batch. Samples will be analyzed for PCP (EPA Method 8151A).

All startup effluent samples will be analyzed for PCP (EPA Method 8151A) to ensure compliance with the AOC. At Baxter's option, effluent samples may also be analyzed for pH (EPA Method 150.1), and total suspended solids (EPA Method 160.2) to provide treatability and process performance information.

The DQO is to confirm the performance of the treatment system and demonstrate the achievement of PCP concentrations no greater than 1 µg/L; a laboratory reporting limit goal for PCP will be 0.5 µg/L.

Task 5.2—Collect Monthly Effluent Samples during Operations

After successful startup of the ESMS (three successive batches with PCP no greater than 1 µg/L), the treatment system will be operated in a continuous mode. We propose to collect samples of treatment plant effluent every month to ensure that the treatment system is achieving the effluent limits identified in the AOC. One sample will be collected for every 14 discharge days in a month. For example, if treated stormwater is discharged for 18 days during a month, two effluent samples will be collected.

All effluent samples collected during continuous operations will be analyzed for PCP (EPA Method 8151A) to ensure compliance with the AOC. At Baxter's option, effluent samples may also be analyzed for pH (EPA Method 150.1), total suspended solids (EPA Method 160.2), and/or dioxins/furans (EPA Method 1613B) to provide treatability and process performance information.

The DQO is to confirm the continued performance of the treatment system and demonstrate the achievement of PCP concentrations no greater than 1 µg/L. The laboratory reporting limit goal for each analyte as described in Appendix B will be achieved.

Task 5.4—Collect Process Control Samples during Operations

Process control samples will be collected from three locations within the treatment train: influent, clarifier effluent, and between the activated carbon units. Process control samples will be collected at system startup and as needed thereafter. Process control samples will be collected on the same day as effluent samples. The purpose of these samples is to ensure proper operation of the treatment system and to determine when maintenance (e.g., exchange of activated carbon units) is required.

Influent and clarifier effluent samples will be analyzed for pH (EPA Method 150.1), total suspended solids (EPA Method 160.2), and PCP (EPA Method 8151A)

Samples collected between the granular activated carbon units will be analyzed for pH and PCP.

The DQO is to monitor performance throughout the treatment process and trigger maintenance events (e.g., replacement of activated carbon units) prior to any exceedence of discharge criteria. The laboratory reporting limit goal for each analyte is described in Appendix B.

Task 5.5—Collect Waste Characterization Samples for Treatment System Wastes

Samples will be collected of wastes generated by the ESMS to characterize the waste for compliance with Land Disposal Restrictions (LDR) and collect treatability information. The wastes generated will primarily be settled solids and spent media.

In the LDR, the regulated hazardous constituents for F032 waste include PCP, dioxin/furans, some PAHs, arsenic, and chromium as shown in Table 6. Not all of these constituents are believed to be present in site stormwater. Arsenic and chromium have never been used in site wood treating operations and thus are not present in stormwater in concentrations that could exceed the LDR. Arsenic and chromium will be excluded from the list of parameters analyzed for compliance with the LDR.

To characterize solids for compliance with the LDR, one sample will be collected from each batch of solids generated on site. Each solids sample will be analyzed for PCP (EPA Method 8151A), dioxins/furans (EPA Method 1613B), and PAHs (EPA Method 8270C).

Spent media will be sampled at Baxter's option. To save analytical costs, Baxter may decide to assume that contaminant concentrations in spent media exceed the LDR. If Baxter elects to sample spent media for characterization, one sample will be collected. The sample will be analyzed for PCP (EPA Method 8151A), dioxins/furans (EPA Method 1613B), and PAHs (EPA Method 8270C).

The DQO for the waste characterization samples is to accurately characterize solids and spent media waste streams for compliance with the LDR. The laboratory reporting limit goal for each analyte is described in Appendix B.

Task 7—Conduct Innovative Filtration Treatability Study

We propose to conduct a three-stage media filtration treatability test to evaluate the effectiveness of media other than granular activated carbon. The purpose of the treatability test is to test innovative filtration media that may be more cost-effective for a final stormwater management system. The treatability test will include bench- and pilot-scale testing.

Three media will be evaluated in the bench-scale treatability testing. Although the exact media to be tested have not been determined at this point, media under consideration for inclusion in the test are surface modified zeolite, organoclay, and leaf compost.

Adsorption Capacity Test

The purpose of the adsorption capacity test is to assess ability of each of media to adsorb PCP. Results of this test will be used for screening the media to select a single media for further treatability testing.

The test will be conducted by placing each media in a cylinder with site stormwater. Site stormwater will be treated with polymer to remove TSS and best represent the actual operating conditions of the filtration media. The cylinders will be agitated for 24 hours to allow adsorption of PCP. The 24-hour period allows sufficient time for the adsorption process to reach equilibrium. After 24 hours, the contents of each cylinder will be filtered to separate the media and stormwater. Samples of stormwater from each cylinder will be analyzed for PCP. The following procedure will be used to conduct the test:

- A 15-gallon sample of site stormwater will be collected from the Main Treatment Area Ditch within 24 hours of a precipitation event. The sample will be collected with a submersible pump and stored in clean 4-gallon buckets. The volume of sample will be sufficient to complete all bench-scale treatability testing.

- Collect one filtered (with a 0.45 micron filter) and unfiltered sample from the stormwater for use as controls. Analyze the unfiltered sample for TSS and PCP. Analyze the filtered sample for PCP only.

- All treatability test apparatus (e.g., stainless steel cylinders, spoons, etc.) will be decontaminated before and after the test by the following procedure: Alconox wash, tap water rinse, and triple rinse with deionized water.

Decontamination wash and rinse water will be treated in Baxter's existing on-site process water treatment system as described in the Operations and Maintenance-Waste Management Practices section.

- A known quantity (e.g., 10 grams) of each media will be placed in separate clean stainless steel cylinders.

- 250 mL of site stormwater will be added to each cylinder. Site stormwater will be pretreated with 50 ppm of Catfloc 2953 (the optimal polymer dosage determined in polymer performance testing (Appendix D) and allowed to settle for 3 hours.

- Collect a control sample of polymer-treated stormwater. Analyze for TSS and PCP.

- Each cylinder will be agitated for 24 hours to ensure that equilibrium has been reached.

- After 24 hours, the contents of each cylinder will be filtered with a 1-micron filter to separate the media and adsorbed PCP from the remaining stormwater. Samples will be collected from the remaining stormwater and analyzed for PCP.

- Adsorption capacity will be calculated for each media as the difference between the control stormwater PCP concentration and the remaining concentration after completion of the test.

The media with the lowest PCP concentration remaining in the stormwater has the highest adsorption capacity. However, additional criteria including cost and implementability will be considered in selecting a media for additional treatability testing.

All spent absorbent media used in adsorption capacity testing will be managed as described in the Operations and Maintenance-Waste Management Practices section.

The DQO for the adsorption capacity test is to determine the capacity of each test media to adsorb PCP with sufficient accuracy to be able to select the media most effective at adsorbing PCP. The laboratory reporting limit goal will be 0.5 µg/L for PCP and 5.0 µg/L for TSS.

Pilot-Scale Treatability Test

The purpose of the pilot-scale treatability test is to assess the performance of the selected media in removal of PCP in an actual field application. Pilot scale testing will be performed at Baxter's option and will only be performed if adsorption capacity testing yields favorable results. Pilot-scale testing will consist of installing a treatability test apparatus as a component of the ESMS between the weir tank and the granular activated carbon units. The treatability test vault will receive a portion of the treatment system flow. All effluent from the treatability test will be treated by the activated carbon units prior to discharge. The treatability test will be conducted according to the following procedure:

- Install test apparatus. Test apparatus will consist of a small test vault containing the selected media, an inline flow meter, and an effluent sampling port. The test vault will be sized based on the results of the bench-scale adsorption testing.

- Route a portion of the treatment system flow (approximately 5 to 15 gpm) through the treatability test apparatus. All effluent from the pilot-scale test will be treated through the ESMS granular activated carbon units prior to discharge.

- Duration of the pilot-scale treatability test will be 3 months. The pilot-scale system will treat stormwater whenever the ESMS operates during the 3-month period.

- Influent and effluent samples will be collected at startup and shutdown of the pilot-scale test and approximately biweekly during the duration of the pilot test.

- Pilot system will operate continuously for at least 2 hours prior to collection of any samples.

- Influent samples will be collected from the sampling port located immediately downstream of the weir tank. Effluent samples will be collected from a sampling port in the treatability test effluent line.

- Influent and effluent samples collected during the pilot-scale test will be used to calculate the percent PCP removal by the test media. Samples will be analyzed for PCP and TSS. All samples will be collected in triplicate to provide a statistical basis for making decisions.

- Spent absorbent test media will be disposed of at the conclusion of the pilot-scale test. The media will be managed and disposed of as described in the Operations and Maintenance-Waste Management Practices section.

The pilot-scale test will reveal the ability of the media to remove PCP in a real world application and provide useful information about maintenance requirements and media usage rates for future design.

The DQO for samples collected during pilot-scale treatability test is to accurately assess the ability of the selected media to remove PCP. To achieve this objective the PCP concentration of influent and effluent samples must accurately determined; thus, the laboratory reporting limit goal for PCP will be 0.5 µg/L.

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Table A -1 - Monitoring Performed during Work Plan Implementation

Task	Sample	Location(s)	Frequency	Total Samples	Analyses	Purpose
Investigations for System Design						
2.2	Surface Infiltration Rates	Ditch, Parcels A and B	One Time	5	Double-Ring Infiltrometer	Refine hydrologic model.
2.3	Subsurface Infiltration Rates	Proposed infiltration facility locations	One Time	Up to 9	Double-Ring Infiltrometer	Design infiltration facility.
5.3	Ditch Water Levels	Parcel A Ditches	Daily	270	NA	Determine infiltration in ditches, trigger ESMS operation.
Treatment System Operation Monitoring						
4.4	ESMS Batch Operations	Effluent	3 Batches	3	pH, TSS, PCP	Confirm that treatment system achieves PCP ≤1 ppb.
5.2	ESMS Continuous Operations	Effluent	Monthly	~8	pH, TSS, PCP, Dioxin	Confirm discharge criteria are achieved.
5.4	Process Control Samples	Influent	As needed	~3	pH, TSS, PCP	Monitor performance. Collect filtered and unfiltered PCP samples.
		Clarifier Effluent	As needed	~3	pH, TSS, PCP	Monitor clarifier performance.
		Between GAC Units	As needed	~3	pH, PCP	Monitor performance, trigger change of GAC units.
5.5	Waste Characterization	Solids and spent media	Annual	Varies	PCP, PAH, Dio	Characterize waste relative to LDR's for disposal.
Treatability Test						
6.1	Adsorption Capacity Test	Control - Unfiltered	One Time	3	PCP, TSS	Determine starting concentrations.
		Control - Filtered	One Time	3	PCP	Determine dissolved concentration.
		Control - Polymer-Treated	One Time	3	PCP, TSS	Determine concentrations at start of experiment.
		Each of Three Media	One Time	9	PCP	Determine PCP adsorption capacity of each media.
6.2	Pilot-scale Test	Influent	Every two weeks	24	PCP, TSS	Evaluate media performance in removing PCP.
		Effluent	Every two weeks	24	PCP, TSS	Evaluate media performance in removing PCP.

ATTACHMENT A-1
INFILTRATION TESTING FORM

INFILTRATION TESTING FORM

Project Name ____________________

Job Number ____________________

Technician ____________________

Site Name ____________________

Test Location ____________________

Test Performed: At Grade; _______BGS

Depth to Water Table ____________________

Constants:	Area (in²)	Depth of Liquid (in)
Inner Ring:	________	____________
Annular Space:	________	____________

Soil Temp = ________ at depth of ________

Penetration of rings: Inner ________; Outer ________

Liquid Used ____________________

Liquid level maintained using ____________________

Trial		Date	Time in hr:min	Elapsed Time D/(total) in min	Flow Readings: Inner Ring Reading in inches	Flow Readings: Inner Ring Flow in gpm	Flow Readings: Annular Space Reading in inches	Flow Readings: Annular Space Flow in gpm	Water Temp	Incr. Inf. Rate Inner	Incr. Inf. Rate Outer	Comments: Weather conditions, etc.
1	S											
	E											
2	S											
	E											
3	S											
	E											
4	S											
	E											
5	S											
	E											
6	S											
	E											
7	S											
	E											
8	S											
	E											
9	S											
	E											
10	S											
	E											

Notes/Diagram:

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN (QAPP)

project chemist. He will ensure that analyses are performed according to laboratory standard operating procedures, the laboratory Quality Assurance plan, and the requirements of this QAPP. The address and telephone number for CAS is:

Columbia Analytical Services
1317 South 13th Avenue
Kelso, WA 98626
(360) 577-7222

Triangle Laboratories of Triangle Park, North Carolina will perform the polychlorinated dioxins and furans analyses under subcontract to CAS. The Triangle Laboratories Project Manager, Helen Smpardos, will be the laboratory project manager. She will ensure that analyses are performed according to laboratory standard operating procedures, the laboratory Quality Assurance plan, and the requirements of this QAPP. The address and telephone number for Triangle Laboratories is:

Triangle Labs
801 Capitola Drive
Durham, NC 27713-4411
(919) 544-5729

Quality Objectives and Criteria for Measurement Data

The overall quality assurance objectives for field sampling, field measurements, and laboratory analysis are to produce data of known and appropriate quality to support stormwater management for the Baxter Arlington facility. Appropriate procedures and quality control checks will be used so that known and acceptable levels of accuracy and precision are maintained for each data set. This section defines the objectives for accuracy and precision for measurement data. These goals are primarily expressed in terms of acceptance criteria for the quality control checks performed.

Sample Matrices and Target Analytes

Water samples from the stormwater treatment system will be analyzed to monitor system startup and continuous operations as well as to monitor process control. Selected samples, as listed in the Sampling and Analysis Plan, will be analyzed for pH, total suspended solids (TSS), pentachlorophenol (PCP), and polychlorinated dibenzodioxins and furans (PCDD/PCDF). Selected stormwater treatment system solids samples will be analyzed for PCP, polycyclic aromatic hydrocarbons (PAHs), and PCDD/PCDF.

Conventional Water Parameters

Water samples will be analyzed for pH electrometrically with a pH meter using EPA Method 150.1. Reporting limits for pH shall be to the nearest 0.01 pH units.

TSS will be determined gravimetrically by EPA Method 160.2. Reporting limits for TSS are 5.0 mg/L.

Polycyclic Aromatic Hydrocarbons (PAH)

Selected solids samples for PAH analyses will be extracted by EPA Method 3540C, Soxhlet extraction. Sample extracts will be analyzed by gas chromatography/mass spectrometry using EPA Method 8270C with selected ion monitoring to achieve detection limit goals. Target analytes and reporting limit goals are presented in Table B-1.

Pentachlorophenol

PCP analysis will be performed on water and treatment system solids using EPA Method 8151A. Sample extracts will be methylated using diazomethane and analyzed by GC/ECD using dual column confirmation. It should be noted that organic acids may interfere with the method and can result in false positive results. These interferences cannot be removed by cleanup procedures. Reporting limit goals are 0.2 μg/L for PCP in liquid matrices and 5 μg/kg for PCP in solids.

PCDD/PCDF

Water and solid samples submitted for PCDD/PCDF analysis will be extracted and analyzed according to EPA Method 1613B. Target analytes and reporting limit goals are presented in Table B-2.

Sample Containers, Preservation, and Holding Times

Sample container requirements vary according to analyte and sample matrix. Precleaned sample containers will be obtained from the laboratory. All sample containers shall be cleaned following the requirements described in *Specifications and Guidance for Contaminant-free Sample Containers* (EPA 1992).

Samples will be preserved according to the requirements of the specific analytical methods to be employed and all samples will be extracted and analyzed within method specified holding times. Required sample containers, preservatives, and holding times are summarized in Table B-3.

Quality Control Requirements

Laboratory QA/QC

The analytical laboratory will conduct a series of QA/QC checks on the data. These include, but are not limited to: analysis of surrogate compounds, method blanks, matrix spikes, and matrix spike duplicates. Laboratory QC checks and acceptance criteria are presented in Tables B-4, B-5, B-6, and B-7 for conventional parameters, PAH, chlorinated phenols, and PCDD/PCDF compounds, respectively.

Field QA/QC

Hart Crowser will employ a series of field QA/QC measures to ensure sample integrity during collection, storage, and shipping to the analytical laboratory. These procedures will ensure the sample is representative of the intended water supply well and was not compromised by procedural artifacts. Routine field quality control samples will be limited to "blind" duplicate samples though, at least for the initial sampling event, "blind" distilled water blanks will be submitted to the laboratory for PCP and PCDD/PCDF analysis. Temperature blanks will be included in each sample shipment to the laboratory. Field QC checks and acceptance criteria are presented in Tables B-4, B-5, B-6, and B-7 for conventional parameters, PAH, chlorinated phenols, and PCDD/PCDF compounds, respectively.

Laboratory Documentation

The laboratory data reports will consist of a complete CLP-type data package that will contain complete documentation and raw data to allow independent data reduction and verification of analytical results from laboratory bench sheets and instrument raw data outputs. Each laboratory data report will include the following:

- Case narrative identifying the laboratory analytical batch number; matrix and number of samples included; analyses performed and analytical methods used; description of any problems or exceedence of QC criteria and corrective action taken. The laboratory manager or their designee must sign the narrative.

- Copy of chain of custody forms for all samples included in the analytical batch.

- Tabulated sample analytical results with units, data qualifiers, sample volume, dilution factor, laboratory batch and sample number, Hart Crowser sample number, and dates sampled, received, extracted, and analyzed all clearly specified. Surrogate percent recoveries will be included for organic analyses.

- Blank summary results indicating samples associated with each blank.

- Matrix spike/matrix spike duplicates result summaries with calculated percent recovery and relative percent differences.

- Laboratory control sample results, when performed, with calculated percent recovery.

- All calibration, quality control, and sample raw data including chromatograms, mass spectra, quantitation reports, and other instrument outputs.

- Electronically formatted data deliverable (diskette) results.

Data Validation

Analytical data generated by laboratories will undergo a QA/QC review by Hart Crowser chemists. Data validation results will be documented in memoranda reports. Data will be verified by the project QA chemist by reviewing and comparing results entered into the analytical database with validation memoranda prior to subsequent data reduction and evaluation.

A data validation review of data precision and accuracy will be performed on all results using quality control summary sheet results provided by the laboratory for each data package. The data validation review is based on the quality control criteria and format of the EPA National Functional Guidelines and Organic Data Review modified to include specific criteria of individual analytical methods. Raw data (instrument tuning, calibrations, chromatograms, spectra, instrument printouts, bench sheets and laboratory worksheets) will be reviewed if problems or discrepancies are discovered. If outliers occur during calibration or calibration verification, the laboratory will note the incident in the data narrative and professional judgment will be used to determine any necessary actions. The following is an outline of the review format:

- Verify sample numbers and analyses match the chain of custody request;

- Verify sample preservation and holding times;
- Verify that field and laboratory blanks were performed at the proper frequency and that no analytes were present in the blanks;
- Verify field and laboratory duplicates, matrix spikes, and laboratory control samples were run at the proper frequency and that control limits were met;
- Verify surrogate compound analyses have been performed and that results met the QC criteria;
- Verify required limits of detection limits have been achieved; and
- Data validation qualifier flags, beyond any applied by the laboratory, will be added to sample results that fall outside the QC acceptance criteria.

Data validation qualifier flags, beyond any applied by the laboratory, will be added to sample results that fall outside the QC acceptance criteria.

Data validation reports documenting data quality will be prepared for each laboratory data package as it is received. Copies will be submitted to the Hart Crowser Project Manager.

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Table B-1 - PAH Analytes and Reporting Limit Goals

PAHs (Method 8270C-SIM)	Reporting Limit Goals[a] in µg/kg
Acenaphthene	5
Acenaphthylene	5
Anthracene	5
Benzo(a)anthracene	5
Benzo(a)pyrene	5
Benzo(b)fluoranthene	5
Benzo(g,h,I)perylene	5
Benzo(k)fluoranthene	5
Carbazole	5
Chrysene	5
Dibenz(a,h)anthracene	5
Fluoranthene	5
Fluorene	5
Indeno(1,2,3-cd)pyrene	5
2-Methylnaphthalene	5
Naphthalene	5
Phenanthrene	5
Pyrene	5

[a] Reporting limit goals are based on the lowest calibration standard analysis of clean sample matrices assuming a method-specific sample volume or weight. Actual analyte reporting limits are matrix- and sample-dependent and may be higher depending upon sample weight or volume, moisture content, final extract volume, analytical interferences, and any required sample dilutions.

Table B-2 - PCDD/PCDF Analytes and Reporting Limit Goals

PCDD/PCDF (Method 1613B)	Reporting Limit Goals[a] in pg/L
2,3,7,8-TCDD	5
1,2,3,7,8-PeCDD	5
1,2,3,4,7,8-HxCDD	5
1,2,3,6,7,8-HxCDD	5
1,2,3,7,8,9-HxCDD	5
1,2,3,4,6,7,8-HpCDD	10
OCDD	10
2,3,7,8-TCDF	5
1,2,3,7,8-PeCDF	5
2,3,4,7,8-PeCDF	5
1,2,3,4,7,8-HxCDF	5
1,2,3,6,7,8-HxCDF	5
2,3,4,6,7,8-HxCDF	5
1,2,3,7,8,9-HxCDF	5
1,2,3,4,6,7,8-HpCDF	10
1,2,3,4,7,8,9-HpCDF	10
OCDF	10

a Reporting limit goals are based on the lowest calibration standard analysis of clean sample matrices assuming a method-specific sample volume or weight. Actual analyte reporting limits are matrix- and sample-dependent and may be higher depending upon sample volume, final extract volume, analytical interferences, and any required sample dilutions.

Table B-3 - Sample Containers, Preservation, and Holding Times

Analysis	Matrix	Container	Preservation	Holding Time[a]
pH	Water	1 - 100 mL HDPE bottle	No headspace, cool to 4° C	ASAP
Total suspended solids (TSS)	Water	1 - 1 L HDPE bottle	cool to 4°C	7 days
Polycyclic Aromatic Hydrocarbons (PAHs)	Solids	1 – 4 oz glass jar	cool to 4° C	14 days (extraction) 40 days (analysis)
Pentachlorophenol (PCP)	Water Sediment/sludge/TCLP	1 – 1 L amber glass 1 – 8 oz glass jar	cool to 4° C	7 days (extraction) 40 days (analysis)
Dioxins/Furans (PCDD/PCDF)	Water	2 - 1 L amber glass	cool to 4° C	6 months

[a] Holding times are from date of sample collection.

Table B-4 - Summary of Quality Control Procedures, Criteria, and Corrective Actions for Conventional Water Parameters

pH – EPA 150.1. ; TSS – EPA 160.2			
Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Field Quality Control			
Duplicate	1 every 20 or fewer field samples	≤ 35% RPD (water)	Evaluate data for usability
Temperature blank	1 in every cooler shipped	Temperature = 4° C ± 2° C	Evaluate data for usability
Laboratory Quality Control			
Initial calibration (pH)	Daily or each time instrument is set up		
Continuing calibration verification (pH)	Every 10 analytical samples or every 2 hours and at the beginning and end of each run	90 to 110% of initial calibration	Recalibrate instrument and re-analyze affected samples
Method blank (TSS)	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 5 times the blank level
Matrix spike or LCS	1 per batch of every 20 or fewer samples	50 to 150% recovery	Evaluate data for usability
Laboratory duplicate	1 per batch of every 20 or fewer samples	≤ 35% RPD (water)	Evaluate data for usability

Table B-5 - Summary of Quality Control Procedures, Criteria, and Corrective Actions for PAH Analysis

PAHs - EPA 8270 mod GC/MS-SIM			
Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Field Quality Control			
Duplicate	1 every 20 or fewer field samples	Water- < 35% RPD Soil- < 50% RPD	Evaluate data for usability
Laboratory Quality Control			
Method blank	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and reanalyze associated samples unless concentrations are > 5 x blank level
Initial calibration	5-point calibration prior to analysis of samples	Average RRF > 0.1 %RSD < 25%	Recalibrate instrument
Continuing calibration	Every 12 hours with mid-range standard	% Difference < 20% of initial calibration	Recalibrate instrument and re-analyze affected samples
Instrument performance check (tuning)	DFTPP; Daily prior to sample analysis or each 12-hour period, whichever is more frequent	SW-846,Method 8270C, Section 7.3.1.1, Table 3	Retune and recalibrate instrument; reanalyze affected samples
Internal standards	Every sample and calibration standard mix	Areas within –50% to +100% of initial calibration	Reanalyze affected samples
System monitoring compounds (surrogates)	Every lab and field sample	See Table B-8	Evaluate data for usability
Retention time windows	All samples and continuing calibration checks	±0.06 relative retention time units (sample and standard)	Reanalyze affected samples
Qualitative identification (ion intensity ratios)	All samples	SW-846, Method 8270C, Section 7.6	Evaluate data for usability
Matrix spike	1 per batch of every 20 or fewer samples	See Table B-8	Evaluate data for usability
Matrix spike duplicate	1 per batch of every 20 or fewer samples	See Table B-8	Evaluate data for usability
Laboratory control sample	1 per batch of every 20 or fewer samples	See Table B-8	Evaluate data for usability

Table B-6 - Summary of Quality Control Procedures, Criteria, and Corrective Actions for Chlorinated Phenols Analysis

Pentachlorophenol - EPA 8151A mod GC/ECD			
Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Field Quality Control			
Duplicate	1 every 20 or fewer field samples	Water - ≤ 35% RPD	Evaluate data for usability
Distilled water blank	Minimum of the 1st sampling event	All analytes < reporting limit	Qualify all results < 5 times the blank concentration as undetected
Temperature blank	1 in every cooler shipped	Temperature = 4° C ± 2° C	Evaluate data for usability
Laboratory Quality Control			
Method blank	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and reanalyze associated samples unless concentrations are > 5 times the blank level
Initial calibration	5-point external calibration prior to analysis of samples	%RSD < 25%	Recalibrate instrument
Continuing calibration	Every 10 samples with mid-range standard	% Difference ≤ 20% of initial calibration	Recalibrate instrument and re-analyze affected samples
System monitoring compounds (surrogates)	4-Bromo-2,6-dichlorophenol Every lab and field sample	Water- 40 to 100% recovery	Evaluate data for usability
Retention time windows	All samples and continuing calibration checks	±0.06 relative retention time units (sample and standard)	Reanalyze affected samples
Matrix spike	1 per batch of every 20 or fewer samples	33 to 128% recovery	Evaluate data for usability
Matrix spike duplicate	1 per batch of every 20 or fewer samples	RPD < 35%	Evaluate data for usability
Laboratory control sample	1 per batch of every 20 or fewer samples	41 to 115% recovery	Evaluate data for usability

Table B-7 - Summary of Quality Control Procedures, Criteria, and Corrective Actions for PCDD/PCDF Analysis

PCDD/PCDF – EPA 1613B High resolution GC/MS			
Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Field Quality Control			
Duplicate	1 every 20 or fewer field samples	Water- ≤ 35% RPD	Evaluate data for usability
Distilled water blank	Minimum of the 1st sampling event	All analytes < reporting limit	Qualify all results < 5 times the blank concentration as undetected
Temperature blank	1 in every cooler shipped	Temperature = 4° C ± 2° C	Evaluate data for usability
Laboratory Quality Control			
Method blank	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and reanalyze associated samples unless concentrations are > 5 times the blank level
Initial calibration	5-point calibration prior to analysis of samples	Method 1613B, Section 10.1; %RSD < 20%	Recalibrate instrument
Continuing calibration	Every 12 hours with mid-range standard	Method 1613B, Section 15.3, Table 6	Recalibrate instrument and reanalyze affected samples
Instrument performance	PFK lock mass	Method 1613B, Section 10.1, Table 8	Retune and recalibrate instrument; reanalyze affected samples
Recovery standards ($^{13}C_{12}$-1,2,3,4-TCDD) ($^{13}C_{12}$-1,2,3,7,8,9-HxCDD)	Every sample and calibration standard mix	Method 1613B, Section 17, Table 4	Reanalyze affected samples
Labeled spiking compounds See Method 1613B, Table 1	Every lab and field sample	Method 1613B, Section 15.3, Table 7	Evaluate data for usability
Retention time windows	All samples and continuing calibration checks	Method 1613B, Section 16, Table 2	Reanalyze affected samples
Qualitative identification (ion intensity ratios)	All samples	Method 1613B, Section 17, Table 9	Evaluate data for usability
Cleanup standard (^{37}Cl-2,3,7,8-TCDD)	All sample extracts prior to cleanup	Method 1613B, Section 15.3, Table 6	Re-extract and reanalyze associated samples
Laboratory control sample	1 per batch of every 20 or fewer samples	60 to 140% Recovery	Evaluate data for usability

Table B-8 - Laboratory Control Limits for Matrix Spikes, Matrix Spike Duplicates, and Surrogate Spikes for PAH Analysis

Spike/Surrogate Compound	Advisory Limits			
	Percent Recovery		Relative Percent Difference (RPD)	
	Water	Soil	Water	Soil
Matrix Spike/Matrix Spike Duplicate				
Acenaphthene	28 – 116	30 – 116	30	40
Pyrene	32 – 130	25 – 129	30	40
Benzo(a)pyrene	47 – 130	29 - 129	30	40
Laboratory Control Sample				
Acenaphthene	28 – 116	30 – 116		
Pyrene	32 – 130	25 – 129		
Benzo(a)pyrene	47 - 130	29 – 129		
Surrogates				
Fluorene-d10	26 – 105	49 - 135		
Fluoranthene-d10	25 – 117	68 - 121		
Terphenyl-d14	30 – 120	47 - 129		

APPENDIX C
BEST MANAGEMENT PRACTICES (BMPs) ASSESSMENT

APPENDIX C
BEST MANAGEMENT PRACTICES (BMPS) ASSESSMENT

BMPs are physical, operational, or managerial practices that reduce or prevent stormwater pollution. BMPs are typically grouped into two categories—source control and treatment. Source control BMPs, by preventing stormwater pollution before it occurs, are considered the most effective means of reducing stormwater pollution (Ecology 2000a).

This appendix provides a detailed review of available BMPs for the wood treating industry, describes Baxter's current implementation of BMPs, and recommends three additional BMPs for implementation during operation of the Excess Stormwater Management System. The list of BMPs applicable to the wood treating industry was generated from the following documents:

- Pressure Wood Preserving Facilities in Washington State: An Overview of Best Management Practice Implementation, (Ecology 1998);

- Guidance Manual for Developing a Stormwater Pollution Plan for Industrial Facilities, (Ecology 2000a); and

- Wood Preserving Resource Conservation and Recovery Act Compliance Guide (EPA 1996).

Implemented BMPs

Baxter's implementation of BMPs aimed at source control began at purchase of the facility in 1970. Before beginning operations, Baxter completed upgrades to the existing wood treating facility including installation of secondary containment and construction of roofs. Since 1990, Baxter has worked with Ecology and EPA to implement source control BMPs and reduce the risk of stormwater contamination. Baxter's history of site improvements was summarized in the Compliance Report and Plan of Action submitted to Ecology in 2000 (Baxter 2000b).

- 1990 - Constructed a new butt tank with secondary containment.

- 1991 - Roofed the Main Treatment Area.

- 1992 - Installed drip pads in compliance with Subpart W. Prepared a Contingency Plan for incidental and infrequent drippage in the treated pole storage area (Environmental Services 1993). Implemented daily inspections of drip pad and Treated Pole Storage Area.

- 1994 - Prepared a Stormwater Pollution Prevention Plan (Baxter 1994). Began quarterly sampling of storm drains and monitoring wells.

- 1997 - Completed an All Known and Reasonable Technologies (AKART) analysis for preventing and treating PCP in stormwater (AGI 1997).

- 1999 - Began treating cooling tower water with activated carbon. Resealed the drip pad, aprons, and secondary containment units. Completed a bioswale treatability study (AGI 1999).

- 2000 - Closed storm drains in the treated wood storage and Main Treatment Areas. Completed Polymer-Enhanced Settling Treatability Test (Hart Crowser 2000b).

Baxter's SWPPP, SPCC Plan, drip pad management plan, and incidental drippage plan identify many BMPs for preventing the contamination of stormwater with PCP as well as other contaminants. As a component of the site SWPPP and SPCC Plan, Baxter has also implemented BMPs that are not specific to PCP such as good housekeeping, pollution prevention training, inspections, petroleum product transfer procedures, etc. These BMPs were not included here to focus on BMPs directly affecting PCP and dioxins. BMPs already implemented on site are discussed in the following documents:

- Stormwater AKART Analysis, Baxter Facility, Arlington, Washington (AGI 1997);

- Contingency Plan for Incidental and Infrequent Drippage in the Treated Pole Storage Yard for J.H. Baxter, Arlington, Washington, (Environmental Services 1993);

- Drip Pad Management Program, J.H. Baxter, Arlington, Washington, Revised (Environmental Services 1994);

- Stormwater Pollution Prevent Plan (SWPPP), J.H. Baxter, Arlington Plant, (Baxter 1994); and

- Spill Prevention Control and Countermeasure (SPCC) Plan, J.H. Baxter, Arlington Plant, (Baxter 2000).

The current implementation status of BMPs is listed in Table C-1. Table C-1 also lists BMP implementation status in 1998 as evaluated by Ecology. The 1998 column represents the perspectives of both the Ecology permit manager and a Baxter representative. In most cases, the two opinions agree and the agreed opinion is shown. If there is a difference in perspective, both opinions are shown with the Ecology permit managers' listed first and Baxter's representative's listed second.

The list of BMPs in Table C-1 was compiled from Ecology (1998); not all of the BMPs apply, but we provide a complete listing for assessment of applicability to Baxter. BMPs P1 through P10 are permit conditions from Baxter's 1994 NPDES permit. BMPs S1 through S10 are recommended BMPs from Ecology's Stormwater Management Manual for Puget Sound Basin (1992); these BMPs are not permit requirements. The remaining BMPs (A1 through A19, and O1 through O6) were identified from stormwater management practices at other wood treaters in Washington by Ecology (1998) or are specific to the site. The "A" indicates an "additional" BMP and "O" indicates the BMP applies only to facilities using organic preservatives (e.g., PCP).

The list of BMPs prepared by Ecology (1998) lumps together wood treaters preserving different sizes of wood (poles vs. dimension lumber) with different wood preservatives (inorganic [e.g., CCA] vs. organic [e.g., PCP]). Thus, not all of the BMPs in Table C-1 are applicable to pole treaters exclusively using PCP; many of the BMPs are applicable only to facilities treating dimension lumber or using CCA or other metals-based preservatives.

Screening of Additional BMPs

Table C-2 evaluates potentially applicable BMPs that are not yet fully implemented for inclusion as a component of the ESMS. Criteria for screening BMPs included feasibility, effectiveness, applicability, and cost. In the screening, BMPs were included in the ESMS, retained for consideration during planning for a final stormwater management system, or eliminated.

The BMPs to be implemented in ESMS generally relate to maintaining hydraulic control of stormwater by improving hydraulic separation of Parcels A and B, documenting hydraulic control along the site perimeter, and segregating clean stormwater. The following three BMPs will be implemented as a component of the ESMS. One additional source control BMP is proposed for the Untreated Pole Storage Area. Details of how these BMPs will be implemented are presented below.

Several BMPs that are not feasible during interim stormwater management, but are promising for reducing stormwater contamination, were retained for future study. Generally, these BMPs involved major construction or changes in stormwater collection and discharge that are not feasible in the short time schedule for interim stormwater management. Additionally, these BMPs may conflict with remedial actions likely to be identified in the Corrective Measures Study.

BMPs that are extremely cost inefficient, conflicted with industry standards, or would not lead to a reduction in spread of PCP contamination were eliminated from consideration. Each of the eliminated BMPs were also eliminated in AGI's 1997 AKART study.

Recommended BMPs

Improved Runoff and Collection Facilities (BMP S8a). Implementation of this BMP on the Arlington site means completing the separation of stormwater into three source areas: Treated Pole Storage Area, Main Treatment Area, and Untreated Pole Storage Area.

To separate the Main Treatment Area from the Treated Pole Storage Area, the culvert connecting former drains 13 and 14 to the Treated Pole Storage Area Ditch will be closed. A new culvert will be constructed from near former drain 13 to the Main Treatment Area Ditch. The sump pump will be moved from former drain 14 to former drain 13 to pump water through the new culvert into the ditch.

Hydraulic separation of the Untreated Pole Storage Area and the Main Treatment Area is essentially complete, with the exception of a small degree of stormwater ponding at former drains 25 and 26. A culvert will be installed from former drain 26 to the Main Treatment Area Ditch (near former drain 24) to allow for collection of any Main Treatment Area stormwater that ponds in this portion of Parcel B. This culvert also allows for a single pump station location for the ESMS. Any areas that may need regrading will be identified in the topographic survey described in the Data Sufficiency for Design section.

By implementing this BMP, Baxter will provide additional control over potential sources of PCP contamination. Also any overflow from the Treated Pole Storage Area will be routed to the ESMS.

Replace Wood Pole Storage Skids with Inert Material (BMP A10). This BMP is in progress of being implemented for the Untreated Pole Storage Area. Currently, a small number of treated skids are used in the untreated area. Baxter is in the process of replacing these skids with untreated skids. Implementation will be an ongoing process as cost-effective replacement of skids can only occur when the stockpile of poles stored on the skid has been reduced through normal operations.

This BMP cannot be implemented for the Treated Pole Storage Area because industry standards require the use of treated skids. Metal or concrete skids could damage treated poles.

Containment of Stormwater on Site (BMP A15). The site is bermed to prevent off-site discharge of stormwater. The potential for stormwater release is minimal, and no known discharges have occurred. Implementation of this BMP will consist of a new topographic survey and field survey during a precipitation event to document complete containment. Higher berms or other containment measures will be constructed for any areas identified during the site walk that may need additional containment.

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Table C-1 - Best Management Practices Implementation Status

BMP #	Status 1998	Status Now	BMP Description	Implementation Notes
P1a	✓	✓	Where preservement chemicals including preservement formulation precursors are a) received, [and b) stored, c) processed or otherwise handled], appropriate containment, drainage control and/or diversional structures shall be provided to prevent stormwater run-on and contamination. Such structures may include: roofs, covers, curbing, culverts, gutters, or similar structures to prevent the contact of uncontaminated stormwater with process wastewater or process pollutants.	Implemented
P1b	✓	✓	b) stored	Implemented
P1c	P	✓	c) processed or otherwise handled.	Implemented, completely contained.
P2	✓	✓	All liquid chemical storage and process areas shall have secondary containment sufficient to contain the capacity of the largest single tank or vessel. Secondary containment systems shall be sufficiently impervious to contain spilled chemicals until they can be removed or preserved.	Implemented
P3	✓	✓	Preserved product, upon removal from retort, shall remain on drip pad until it has ceased dripping as defined in 40 CFR part 264.572 (k) and 265.443 (k). Preserved product shall be manipulated periodically, if necessary, while on the drip pad to allow the removal of excess treating solution from cracks, checks, and from within bundles of units of wood.	Implemented
P4a	✓	✓	Drip pads shall be (a) designed and installed, and (b) operated in accordance with requirements for drip pads contained in 40 CFR 264 and 265. (a) includes: curbed, lined drip pad, designed to drain liquids to a collection area. Run-on to drip pad should be prevented.	Implemented
P4b	P / ✓	✓	(b) includes: documented, weekly drip pad inspections for cracks or deterioration. Personnel working on the drip pads should decontaminate gear and non-dedicated equipment before they leave the drip pad site, or keep dedicated supplies for use inside the controlled area.	Implemented

Table C-1 - Best Management Practices Implementation Status

BMP #	Status 1998	Status Now	BMP Description	Implementation Notes
P5	P	✓	Separate material handling equipment (forklifts, pettibones, etc.) shall be used for treated and untreated wood whenever feasible. When not feasible, actions shall be taken to ensure process pollutants not tracked to untreated wood storage yard.	Designated equipment used for treated and untreated areas is possible. Occasional crossover happens, but care is taken to minimize occurrence.
P6a	P	P	Stormwater originating from areas outside the treated product storage areas shall be diverted away from these areas.	No areas of run-on. However, drip pad roof and main treatment building roof discharge to surface soils.
P6b	P / X	X	Runoff from the treated product storage area shall be collected or channeled to one or more discrete discharge points to facilitate stormwater sample collection.	Site currently discharges stormwater by infiltration. Collection and conveyance to a centralized treatment system is under evaluation as a long-term alternative.
P7	✓	✓	To the maximum extent practicable, untreated and treated wood shall be stored separately.	Implemented
P8	✓	✓	When not in use, trams shall be stored in such a manner that they will not come into contact with stormwater.	Implemented
P9	✓	✓	The use of detergents and emulsifiers for equipment cleaning, maintenance and repair resulting in a discharge to waters of the state shall be prohibited unless adequate treatment is provided. Oil/water separators and/or sedimentation is not considered adequate treatment.	Implemented
P10	X	X	Infiltration of stormwater from the treated product storage area shall be prevented to the maximum extent practicable.	All stormwater discharge is by infiltration, french drains have been removed.
S1	✓	✓	Ground areas around dip tanks, spray booths, retorts and any other process equipment shall be paved, sloped and drained in a manner that allows the capture and return of treatment chemicals back to the wood treatment process.	Implemented
S2	✓	✓	Dipped lumber shall be required to drip over the dip tank, or be placed on an inclined ramp for a minimum of thirty minutes to allow return of the excess chemical to the dip tank.	Implemented

Table C-1 - Best Management Practices Implementation Status

BMP #	Status 1998	Status Now	BMP Description	Implementation Notes
S3	✓ / NA	✓*	Treated lumber, either from dip tanks or retorts shall be placed in a covered, paved storage area for at least 24 hours before placement in outside storage. A longer storage period shall be used during cold weather unless the temporary storage building is heated. The wood shall be drip free and surface dry before it is moved elsewhere.	Treated poles remain on covered drip pad or over butt tank until drip free and surface dry. Minimum storage period requirements and cold weather sensitivity only apply to CCA treatment not PCP.
S4a	✓	✓	Eliminate non-process traffic on and off the drip pad.	Implemented
S4b	P / NA	NA	A forklift should be dedicated to the drip pad.	No equipment operates on drip pad. BMP applies to dimension lumber treating operations.
S5	✓	✓	Remove and properly dispose of soils with visible surface contamination to decrease the spread of chemicals to ground water and/or surface water via stormwater runoff. Take steps to prevent future occurrences.	Implemented
S6	X / ?	P	Keep treated wood out of areas where surface water drainage is apparent.	Surface water infiltration occurs throughout flat site. Treated poles are kept above surface water by skids.
S7	P / ✓	✓	Scrub down non-dedicated lift trucks on the drip pad.	Implemented
S8a	P	P	Design improved runoff and process water collection facilities for roofs/asphalt, and any ponding areas. Improvements may include segregating clean rainwater from process water.	Process water is contained and collected for treatment. Potential runoff collection improvements include completing the separation of Parcels A and B and the Main Treatment and Treated Pole Storage Areas.
S8b	✓*	✓	Ensure all process water is collected and recycled to the process treatment system.	Process water is collected, treated, and recycled.
S9	P / ✓	✓	If any wood is observed to be contributing chemicals to the environment in the treated wood storage area, relocate it on a concrete chemical containment structure until the surface is clean and until it is drip free and surface dry. Clean up, remove and properly dispose of any contaminated soil from the treated wood storage area.	Implemented
S10	P	✓	Seal any holes that can allow stormwater to migrate from the asphalted area to the soil.	Limited pavement on site. Asphalt drip pad aprons are resealed once per year.

Table C-1 - Best Management Practices Implementation Status

BMP #	Status 1998	Status Now	BMP Description	Implementation Notes
A1	X	X	Treated wood storage under roofs or plastic wrap.	Roofs are not feasible for 100+ ft. utility poles. Plastic tarps are under evaluation.
A2	X / NA	NA	Blocks and stickers from treating process stored under roof.	Treated blocks and stickers are not used onsite.
A3	X / NA	NA	Pressure washing treated wood storage yard each summer. Wash water collected in vacuum truck and pumped into recovery water tank.	Treated Pole Storage Area is unpaved.
A4	P / ✓	✓	Final vacuum applied in treatment cylinder to remove excess preservative.	Implemented
A5	X / NA	NA	Fast-fix hot water treatment system utilizes hot water treatment in a separate dedicated retort following pressure treatment with preservative in a conventional retort. The water removes the excess preservative from the wood and the heat "fixes" the remaining preservative in the wood. Process is claimed to achieve 99.9% fixation of metals.	BMP applies to facilities using metals as a preservative.
A6	P	P	Completely enclosed treatment building, including tank farm, retorts, transfer table and drip pad.	Treatment building, tank farm, retorts, and drip pad are roofed and in secondary containment. Not all areas have walls. Butt tank is unroofed but in secondary containment.
A7	X / P	✓	Cleaning/sweeping of paved areas.	Limited pavement on site. Drip pad aprons are inspected daily and cleaned as needed.
A8	✓	✓	Stop cutting treated wood outside.	Implemented
A9	P / ✓	NA	Sediment filtration catch basin inserts.	French drains have been removed.
A10	X	P	Replace wood pole storage skids with metal or concrete.	The majority of skids in the Untreated Pole Storage Area are made of untreated wood; a few treated wood skids are also used. Treated wood skids are used in the Treated Pole Storage Area per industry standards.
A11	X	X	Vegetated bio-swales that function to remove TSS and oil from runoff. As solids tend to adsorb metals, TSS removal will also reduce concentration of metals in the runoff from treated wood storage yard. Deposits from swales disposed of as hazardous waste.	Ditches and swales are not vegetated, however, TSS is removed by infiltration. Metals (e.g., CCA) are not a wood preservative used on site.

Table C-1 - Best Management Practices Implementation Status

BMP #	Status 1998	Status Now	BMP Description	Implementation Notes
A12	X	X	Settling ponds lined to prevent contaminants from infiltrating into groundwater. To include vegetation with high metal uptake rates.	No settling ponds on site, site ditches and swales are unlined.
A13	X / NA	NA	Wetland plants in detention ponds for metals uptake.	Metals are not a wood preservative used on site.
A14	P / ✓	✓	Ensure wood stock is clean prior to treating to prevent dirt and sawdust from entering the treatment system. This can be achieved through pretreatment quality control, including agreements with suppliers to deliver clean wood stock, or vacuuming, water washing or air pressure cleaning of dirty wood before treatment.	Implemented
A15	X / P	P	Entire perimeter of facility bermed to prevent discharges of untreated stormwater.	Majority of facility bermed. The few unbermed areas are higher ground, thus unlikely to discharge untreated stormwater.
A16	X / NA	NA	Additional blocks used on longer units to reduce pooling of chemicals inside units.	Blocks are not used in pole treatment process. BMP applies to dimension lumber treating facilities.
A17	P / NA	NA	Angled trams to facilitate drainage from treated wood.	BMP applies to dimension lumber treating facilities using CCA as a preservative. Treated poles are rotated while on drip pad to facilitate drying.
A18	P / NA	P	Skids designed to keep treated wood off the ground to reduce contact with standing stormwater.	Skids are used for all treated pole storage. Poles do not sit in stormwater. However, skids are treated poles and do contact stormwater.
A19	X / NA	NA	Automatic lumber handling system that replaces conventional forklift/rail-tram system with automatic chain conveying system to load and unload lumber before and after pressure treatment. Includes an elevated drip pan to intercept drips from retort doors and freshly treated wood. Such systems eliminate the need for both human and equipment traffic on the drip pad and removes any chance of tracking chemicals off the drip pad.	BMP applies to facilities preserving dimension lumber not utility poles.
O1	✓	✓	Care when unloading penta blocks to avoid tearing the plastic covering material or chipping or otherwise breaking the blocks.	Implemented

Table C-1 - Best Management Practices Implementation Status

BMP #	Status 1998	Status Now	BMP Description	Implementation Notes
O2	✓	✓	Penta blocks transferred with plastic wrap in place, covering not removed until block positioned inside penta block dissolver.	Implemented
O3	✓	✓	Weekly inspection and inventory of penta storage shed to prevent deterioration or loss of inventory.	Implemented
O4	X	*	Cooling tower structure modified to reduce the PCP "contribution" to the stormwater from the tower. Panels installed to prevent droplets from escaping due to wind.	Intent met by activated carbon treatment of process water.
O5	X	*	Area under cooling tower paved and sealed, so that any splashes or drips drop onto the pad from the tower and return to the system via drains in the pad.	Intent met by activated carbon treatment of process water prior to evaporation.
O6	X	NA	Storage skids from inert materials will prevent treated wood debris from getting to filter system.	BMP applies to a different stormwater management system than used on site.

Notes:

Status: ✓ = implemented, X = not implemented, P = partially implemented, ? unclear, * intent of BMP met, NA = not applicable

Status 1998 column contains the results of Ecology's study of BMP implementation at wood preserving sites (1998).

Multiple results in the 1998 study indicate the perspective of Ecology's permit manager (shown first) and Baxter's representative.

Table C-2 - Best Management Practices Evaluation

BMP #	Status	BMP Description	Evaluation
P6a	P	Stormwater originating from areas outside the treated product storage areas shall be diverted away from these areas.	Retain for long-term stormwater management.
P6b	X	Runoff from the treated product storage area shall be collected or channeled to one or more discrete discharge points to facilitate stormwater sample collection.	Retain for long-term stormwater management.
P10	X	Infiltration of stormwater from the treated product storage area shall be prevented to the maximum extent practicable.	Retain for long-term stormwater management. Options include paving, lining ditches, etc.
S6	P	Keep treated wood out of areas where surface water drainage is apparent.	Retain for long-term stormwater management.
S8a	P	Design improved runoff and process water collection facilities for roofs/asphalt, and any ponding areas. Improvements may include segregating clean rainwater from process water.	Reroute drainage to collect main treatment area at drain 26. Improve hydraulic separation between Parcels A and B if necessary.
A1	X	Treated wood storage under roofs or plastic wrap.	Eliminated. Roofs are not feasible for 100+ ft. utility poles.
A6	P	Completely enclosed treatment building, including tank farm, retorts, transfer table, and drip pad.	Additional Implementation Eliminated. Roofing the butt tank is not feasible. Constructing side walls has limited benefit and high cost.
A10	P	Replace wood pole storage skids with metal or concrete.	Implement for Untreated Pole Storage Area. Treated poles required by industry standards in treated wood storage area. Any treated wood skids in the untreated wood storage area are currently being replaced by untreated skids.
A11	X	Vegetated bio-swales that function to remove TSS and oil from runoff. As solids tend to adsorb metals, TSS removal will also reduce concentration of metals in the runoff from treated wood storage yard. Deposits from swales disposed of as hazardous waste.	Retain for long-term stormwater management.
A12	X	Settling ponds lined to prevent contaminants from infiltrating into groundwater. To include vegetation with high metal uptake rates.	Retain for long-term stormwater management.
A15	P	Entire perimeter of facility bermed to prevent discharges of untreated stormwater.	Implement by documenting complete containment. Enhance berms if necessary.
A18	P	Skids designed to keep treated wood off the ground to reduce contact with standing stormwater.	Additional Implementation Eliminated. Treated wood skids are currently used in Parcel A. Not feasible to use other skids (see A10).

Notes:
Status: ✓ = implemented, X = not implemented, P = partially implemented, ? unclear, * intent of BMP met, NA = not applicable

APPENDIX D
MEMORANDUM TO BAXTER
RE: BENCH-SCALE POLYMER PERFORMANCE TEST RESULTS

MEMORANDUM

DATE: December 18, 2000

TO: Georgia Baxter, J.H. Baxter & Company

FROM: Barry Kellems, P.E. and Owen Reese, Hart Crowser Inc.

RE: **Bench-Scale Polymer Performance Test Results**
J-7026-05

CC: Tom Orthmeyer, J.H. Baxter

This technical memorandum presents recommendations resulting from our bench-scale polymer performance testing. The bench-scale performance test was performed as Task 3 of the revised scope of work dated November 22, 2000. A summary of conclusions from the test is provided below, followed by a description of test methodology, detailed test results, and a description of polymer injection system operation.

Summary of Conclusions

- Polymer-enhanced settling did not reduce the pentachlorophenol (PCP) concentration in stormwater but did achieve up to 96 percent reduction in Total Suspended Solids (TSS). Post-settling TSS concentrations ranged from 8 to 46 mg/L; the control had a TSS concentration of 184 mg/L.

- PCP in the control sample was reduced from 230 to 53 µg/L by filtering with a 0.45 µm filter. It appears that PCP is primarily associated with very fine suspended solids. The very fine solids are not removed by polymer-enhanced settling, but are removed through analytical solids filtration.

- To reach the 205 ppm discharge limit for PCP, filtration will be required. Available filtration methods include sand, modified zeolite granular activate carbon, and leaf compost media. We are currently preparing a plan for conducting a pilot test to evaluate the available filtration media.

- Polymer-enhanced settling is a useful pretreatment for reducing TSS concentrations prior to additional treatment steps. The best performing polymer is a combination of

CatFLOC 2953 at 50 ppm and NALCLEAR 7768 at 20 ppm. However, CatFLOC alone resulted in sufficient settling and should be considered as a cost-effective alternative.

Performance Test Methodology

Polymer performance testing was performed according to the procedure described in Attachment A of the Interim Stormwater Management Plan (November 28, 2000). The stormwater sample was collected on November 28, 2000, from ponded stormwater at Drain 26. The sample was collected a day after over 1.5 inches of rain had fallen in Arlington (MSNBC Doppler Precipitation Record for November 27, 2000). The polymer performance test was conducted on November 30 and December 1, 2000.

The polymers were prepared following vendor instructions to one percent working solutions. Polymer dosage determination was performed according to the Attachment A procedure. The group of polymers tested was expanded to include three additional Nalco products, NALCLEAR 7768, NALCO 7196, and NALCO 8105; and one combination, CatFLOC 2953 plus NALCLEAR 7768. The full list of polymers tested is included in Table 1.

The three best performing polymers from the dosage determination were compared in a 3-hour parallel jar test. The 3-hour duration conservatively approximates the settling time provided by the weir tank. A HORIBA multiparameter water quality meter was used to observe DO, turbidity, pH, and temperature at 1-hour time points during the test. After the first jar test, the most promising polymer was subjected to a second 3-hour test at 150 percent dosage. Only one polymer was subjected to the 150 percent dosage test, instead of the three indicated in the work plan, because we felt testing the other two would be of little additional value.

Seven samples were submitted to Columbia Analytical Services for PCP analysis (EPA Method 8151 Modified) and five samples were submitted for TSS analysis (EPA Method 160.2). Lab data are presented in Appendix D.

Performance Test Results

Five Polymers Eliminated during Dosage Determination. During the first step of polymer performance testing, the optimal dosage for each polymer was determined. The optimal dose for each polymer and observations made during dosage determination are shown in Table 1. Lab notes from the dosage determination and parallel jar test are in Appendix B; photographs taken during testing are in Appendix C. Two polymers produced no flocculation at any dosage and were eliminated from further testing. Three other polymers did produce some floc, but were eliminated due to poor settling or high optimal dose. The remaining three polymers, CatFLOC 2953, Superfloc A-1849 RS, and a combination of CatFLOC 2953 and NALCLEAR 7768, advanced to the parallel test.

Combination of Polymers Best in Parallel Jar Tests. The combination of CatFLOC and NALCLEAR resulted in the fastest settling and best floc formation of the three polymers (Table 2). The higher dosage (150 percent) of the polymer combination resulted in faster settling and larger floc size, but the difference may not warrant the 50 percent increase in chemical cost. CatFLOC and HydroFLOC were also effective in significantly reducing turbidity, but floc was smaller and took longer to settle. However, CatFLOC did result in sufficient settling to be considered for use on-site if costs or O&M requirements associated with the combination of polymers are excessive. No settling was observed in the control sample.

Water quality measurements recorded during the parallel jar tests (Table 2) show a sharp drop in turbidity after addition of polymer, a minor decrease in pH due to polymer addition, and no change in dissolved oxygen or temperature. Turbidity decreased rapidly in the polymer-treated samples; at the 1-hour time point the turbidity of the polymer-treated samples had decreased to less than 20 NTU. pH decreased slightly (0.2 to 0.7 pH units) in polymer-treated samples.

The combination of CatFLOC and NALCLEAR resulted in sludge production rates of 12 mL/L for the 100 percent dosage and 18 mL/L for the 150 percent dosage. The sludge density (calculated from change in TSS) is at least 13.8 mg/cm^3 for the 100 percent dosage and 9.7 mg/cm^3 for the 150 percent dosage. These sludge densities are low estimates because the polymer mass is not included.

Polymers Effective in Reducing TSS, but Not PCP. Analytical results confirmed that the polymers were effective in reducing TSS by as much as 96 percent (Table 3). The control sample had a TSS and PCP concentrations after 3 hours of settling of 184 mg/L and 230 µg/L, respectively. Since no settling was observed in the control during the 3-hour period, the post-settling TSS result also represents the initial TSS concentration. Both the TSS and PCP concentrations of the control sample are representative of typical concentrations in Parcel A. In 98 stormwater samples collected from Parcel A, TSS has ranged from 5 to 3,140 mg/L with an average of 594 mg/L and PCP has ranged from 1 to 960 µg/L with an average of 292 µg/L. The control sample TSS concentration is 70 percent lower than average, and the PCP concentration is 22 percent lower than the average. The concentrations are well within the historical range.

Reduction in TSS concentrations coincided with visual observations of polymer performance. The CatFLOC and NALCLEAR combinations resulted in the greatest reductions in TSS, followed by CatFLOC alone, and HydroFLOC. However, none of the polymers or polymer combinations reduced PCP concentrations. PCP results for the polymer-treated samples varied slightly from the control, but the difference does not appear significant and likely represents natural variability, sampling error, or laboratory error. Filtering the control sample resulted in a 76 percent reduction in PCP concentration (from 230 to 53 μg/L).

The analytical results indicate that PCP is not associated with larger suspended solids. According to AGI's grain size distribution for ditch sediment, the polymers were effective in removing particles larger than 2 μm. Filtration of the control sample removed particles larger than 0.45 μm. Roughly 75 percent of the PCP concentration appears to be associated with suspended solids between 2 and 0.45 μm; the remaining fraction is either dissolved or associated with even smaller particles.

The lack of change in PCP concentrations following settling is not likely to have resulted from interferences caused by polymer addition. No change in PCP concentration occurred with both anionic and cationic polymers with low and high charge densities. If interference effects were to occur they would not be uniform across ionic spectrum. The slight decrease in pH caused by polymer addition would serve to decrease polymer solubility. There is a minor chance that polymer addition caused an interference with PCP. Small concentrations of polymer remaining in solution after settling may act as a co-solvent, effectively increasing the solubility of PCP.

Conclusions

Polymer-enhanced settling are not effective in removing PCP from stormwater. PCP in site stormwater appears to be associated with very fine particles (<2 μm) or dissolved. Polymer-enhanced settling should not be used as the sole treatment step in the interim treatment system. However, polymer-enhanced settling is effective in reducing TSS and would be a cost-effective method for removing solids prior to more advanced treatment such as filtration.

The recommended polymer for use in reducing TSS is the combination of CatFLOC 2953 at 50 ppm and NALCLEAR at 20 ppm. The 150 percent dosage performed slightly better, but the difference in performance is offset by increased sludge generation and higher chemical cost. Use of CatFLOC alone should be considered because CatFLOC performed well during the parallel test. We propose using CatFLOC initially and adding NALCLEAR if results from CatFLOC are not satisfactory.

Description of Polymer Injection System

The following description of a polymer injection system is provided assuming that polymer-enhanced settling is used as a solids pre-treatment step.

The polymer system involves diluting polymer to a one percent working strength and injecting the polymer into the treatment system influent. Polymer will be shipped to the site in 55-gallon drums. A single 55-gallon drum of CatFLOC 2953 injected at 50 ppm will treat 1.2 million gallons (MG) of stormwater. One drum of NALCLEAR, injected at 20 ppm, will treat 2.8 MG. Chemical prices are $1.15 per pound for CatFLOC ($608 per drum including shipping) and $2.58 per pound for NALCLEAR ($1233 per drum). The price per million gallons treated using CatFLOC is $506, and using CatFLOC and NALCLEAR is $946. MSDSs for both recommended products are provided in Appendix D. A lead time of ten days is required from placement of polymer orders to delivery.

Polymer arrives in concentrated form and will need to be diluted to a one percent working solution prior to use. Working strength solutions are created by mixing a small amount of polymer with high quality make-up water. We recommend a 55-gallon drum be used for mixing polymer, during initial batch operation. During continuous operation we recommend using a 1,000-gallon tank for diluting polymer. One thousand gallons of working strength polymer will treat 0.2 MG of stormwater. By comparison, a 55-gallon drum of one percent working solution would treat only 0.011 MG. The larger batch size reduces O&M requirements by reducing the frequency of making new batches of polymer. Batches of working strength polymer solution are good for up to a month. Both CatFLOC and NALCLEAR polymers need to be kept above 50 °F. This will require either locating the drums inside a heated storage unit (e.g., Conex box) or inside a building.

Polymer is injected into the treatment train using a chemical metering pump. The required feed rate to treat 50 gpm of stormwater with 50 ppm of polymer is 15 gallons per hour (6 gallons per hour for 20 ppm). Once injected into stormwater, the polymer requires mixing to ensure adequate distribution. Mixing can be achieved by injecting into the influent pipe 20 to 30 feet prior to the connection with the weir tank or by injecting upstream of a static mixer. A static mixer is a section of baffled pipe designed to create turbulent flow. Static mixers are available for purchase but can be expensive. It may be possible to create a static mixer by welding baffles inside an iron pipe, or by fitting together several PVC expansions and contraction bushings in rapid succession.

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Attachments:
Table 1 - Dosage Determination Observations
Table 2 - Parallel Jar Test Observations
Table 3 - Polymer Performance Study Results
Attachment A - Analytical Data
Columbia Analytical Services, Inc.
Attachment B - Test Notes
Attachment C - Photographs of Test
Attachment D - MSDS for CatFLOC 2953 and NALCLEAR 7768

Table 1 - Dosage Determination Observations

Polymer	Manufacturer	Polymer Type	Optimal Dose in ppm	Observations	Include in Parallel Test
CatFLOC 2953	NALCO (1)	Liquid, cationic	50	Pin floc, first settles at 40 ppm, bigger floc at 50	YES
HydroFLOC 445 L	Aqua Ben	Liquid, anionic	NA	No floc	NO
NACLEAR 7768	NALCO	Emulsion, anionic	100	Cloudy, some pin floc at 100 ppm, little settling	NO
Superfloc A-1883 RS	Cytec	Emulsion, anionic	NA	No floc	NO
Superfloc A-1849 RS	Cytec	Emulsion, anionic	50	Pin floc, first settles at 50 ppm, similar settling at higher doses	YES
NALCO 7196	NALCO	Liquid, cationic	20	Poor floc formation, still turbid	NO
NALCO 8105	NALCO	Liquid, cationic	20	Stringy floc, not settling, still turbid	NO
CatFLOC 2953 + NACLEAR 7768	NALCO	Combination	50 + 20	Pin floc, settles faster than Catfloc alone	YES

Notes
MW = molecular weight
NA = unable to determine optimal dose due to little or no flocculation.

Table 2 - Parallel Jar Test Observations

Polymer	Dosage in ppm	Notes	Floc Size Rank(a)	Settling Rank(a)	pH	Turb. (NTU)	Temp (C)	DO (mg/L)
		Observations			Parameters			
Start of Test								
Control	-	No floc, no settling	5	5	(b)			
CatFLOC 2953	50	Pin floc	4	3				
CatFLOC 2953 + NACLEAR 7768	50 + 20	Pin floc, grows with time	2	2				
Superfloc A-1849 RS	50	Pin floc	3	4				
150% CatFLOC 2953 + NACLEAR 7768 (c)	75 + 30	Good size floc, settling fast	1	1				
Hour 1								
Control	-	No change	No change in rank		6.71	330	17.8	6.8
CatFLOC 2953	50	Cloudy, some floc settled			6.30	<10	17.7	6.5
CatFLOC 2953 + NACLEAR 7768	50 + 20	Clear supernatant, no floc			6.25	<10	18.1	6.9
Superfloc A-1849 RS	50	Cloudy, some floc settled			6.54	14	17.5	8.1
150% CatFLOC 2953 + NACLEAR 7768 (c)	75 + 30	Clear supernatant, no floc			6.00	<10	17.1	6.5
Hour 2								
Control	-	No change	No change in rank		6.70	265	18.7	6.7
CatFLOC 2953	50	Continuing to get clearer			6.27	<10	18.8	6.9
CatFLOC 2953 + NACLEAR 7768	50 + 20	No change			6.27	<10	19	6.6
Superfloc A-1849 RS	50	Slightly clearer			6.30	9	18.6	6.8
150% CatFLOC 2953 + NACLEAR 7768 (c)	75 + 30	No change			6.10	<10	17.8	7.8
Hour 3: End of Test								
Control	-	No change	No change in rank		6.65	242	19.4	6.6
CatFLOC 2953	50	Still getting clearer			6.24	<10	19.3	6.5
CatFLOC 2953 + NACLEAR 7768	50 + 20	No change			6.21	<10	19.5	6.7
Superfloc A-1849 RS	50	No change			6.2	15	19.2	6.4
150% CatFLOC 2953 + NACLEAR 7768 (c)	75 + 30	No change			6.12	<10	18.3	7.0

Notes:

a) Ranked from 1 = best to 5 = worst

b) Water quality parameters were not measured at the start of the test because the multiparameter probe would have interfered with floc formation.

c) Test at 150% was run on the day after the majority of testing. The 150% test was run parallel to a Control and a 100% version. Water quality parameters and notes for the control and 100% version were similar to those of the day before and for simplicty are not reported here.

Table 3 - Polymer Performance Study Results

Sample	Dosage in ppm	PCP in µg/L	TSS in mg/L
Control Settled	-	230	184
Control Settled + Filtered	-	53	-
Catfloc 2953	50	240	28
Catfloc 2953 + NACLEAR 7768	50 + 20	240	18
Superfloc A-1849 RS	50	250	46
150% Catfloc 2953 + NACLEAR 7768	75 + 30	230	8
Equipment Blank	-	1.0 U	-

Notes:

U = not detected at indicated detection limit.

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