ENGINEERING DESIGN DOCUMENT

FINAL REPORT

FORMER CHAMPION BALLARD MILL
SEATTLE, WASHINGTON

Prepared for

CHAMPION INTERNATIONAL CORPORATION
SEATTLE, WASHINGTON

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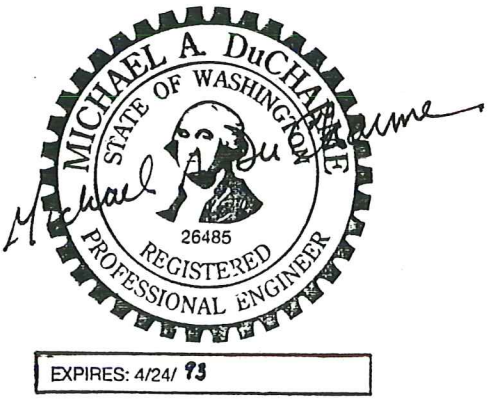

K/J 916016.02

August 1992

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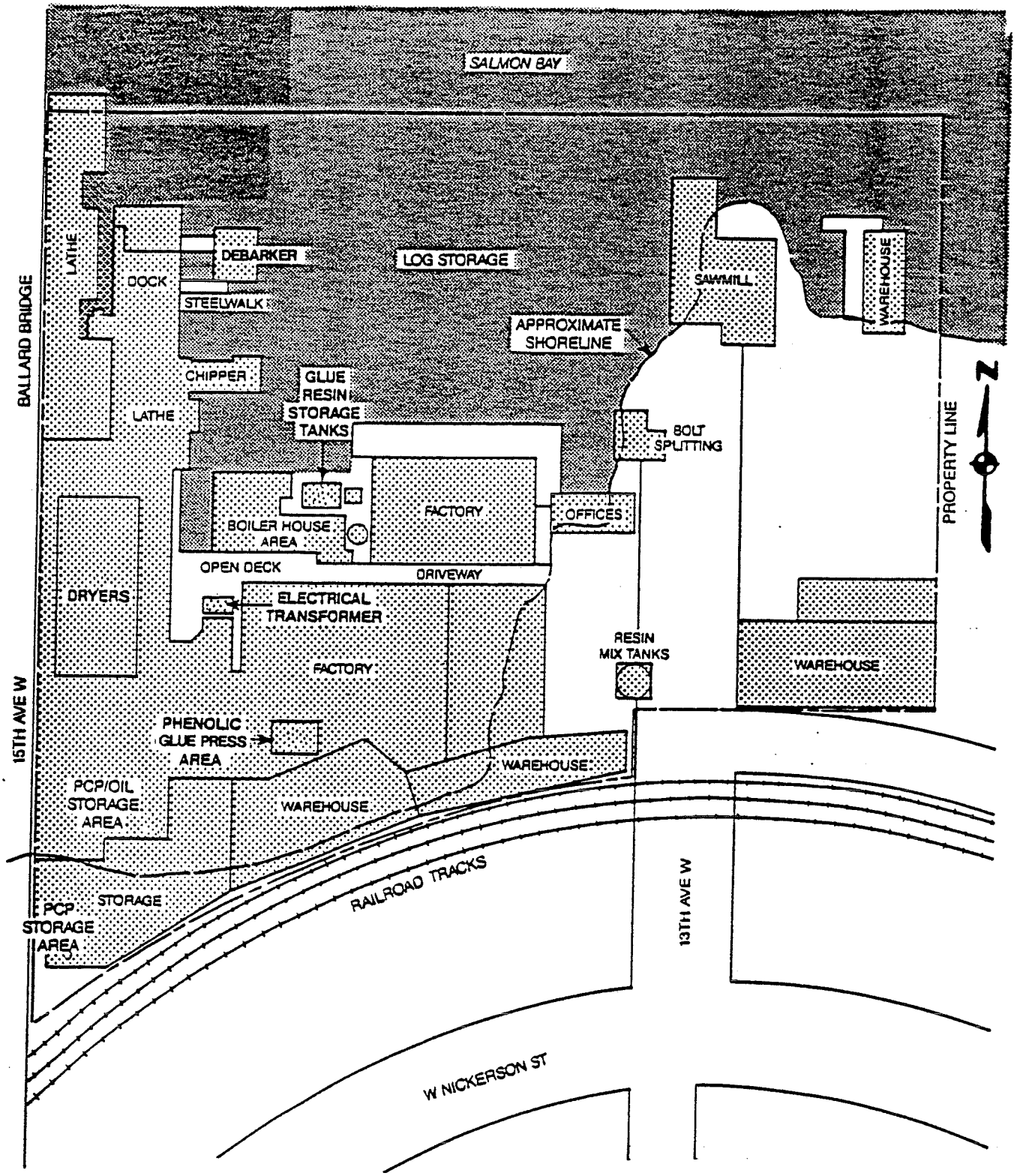
1.0 INTRODUCTION

This report outlines the specific activities and engineering design requirements that will be used during implementation of the remedial action at the Champion International Corporation - former Ballard Mill (Champion) site located at 4025 13th Avenue West in Seattle, Washington (Figure 1-1). This report also identifies operation and maintenance activities that will be performed to maintain the selected remedial action and compliance monitoring activities that will be performed to assure its effectiveness. The remedial action for the Champion site is being performed in fulfillment of the Consent Decree between the Washington State Department of Ecology (Ecology) and Champion International Corporation, Salmon Bay Terminal (SBT), and Coastal Transportation, Inc. (Coastal).

1.1 BACKGROUND

Closure of the Champion site occurred in January 1985. In August 1985, Parametrix, Inc. (Parametrix) performed an environmental audit of the Champion site. Subsequently, several more investigations and cleanup actions were performed by Parametrix and Kennedy/Jenks Consultants. In September 1989, Ecology signed a Agreed Order (No. DE 89-N162) with Champion for implementation of a supplemental remedial investigation, risk assessment, and feasibility study (RI/RA/FS) to address remaining environmental concerns at the site. The RI/RA/FS activities were performed in accordance with Ecology's Model Toxics Control Act (MTCA). The results of the RI/RA/FS are summarized in a final report to Champion (Kennedy/Jenks/Chilton 1991). Through performance of the RI/RA/FS, a remedial alternative was selected for the site. In February 1992, a cleanup action plan (CAP) was developed for the site which summarized the results of the RI/RA/FS (Kennedy/Jenks Consultants 1992), detailed the specific activities of the selected remedial action, provided justification for these activities, and established a preliminary schedule for implementation of the selected alternative. In



1"=150' 0 150 225 (feet)

Approximate Scale:

Kennedy/Jenks Consultants

CHAMPION INTERNATIONAL CORP.
SEATTLE, WA

SITE MAP

916016.02/P2SK005

FIGURE 1-1

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.
2. MAP SOURCE FROM PARAMETRIX,INC., REPORT DATED 3/27/87 (PARAMETRIX,1987).

April 1992, a second Consent Decree between Ecology, Champion, SBT, and Coastal is awaiting public comment. Following public comment, the Consent Decree will be signed to implement the selected remedial alternative as outlined in the CAP. This Engineering Design Document (EDD) is cited in the aforementioned Consent Decree and will become a part of the administrative record.

2.0 ENGINEERING DESIGN

This section describes issues associated with the design of remedial action described in the CAP for the former Champion site. This section:

- Describes the remedial alternative
- Addresses how site conditions could affect design components and discusses the engineering justification for the design elements
- Presents short- and long-term health and safety issues
- Briefly outlines applicable federal and state requirements
- Provides a construction schedule.

This section was prepared in accordance with Chapter 173-340-400 WAC, Cleanup Actions.

2.1 DESCRIPTION OF THE REMEDIAL ACTION

The CAP (Kennedy/Jenks Consultants February 1992) presents a description and justification for the remedial actions for each operable unit at the Champion site. The following table summarizes the selected remedial alternatives for each operable unit.

TABLE 2-1

SUMMARY OF REMEDIAL ACTIONS

Operable Unit	Selected Remedial Action
Entire Site	Land use restrictions and long-term groundwater monitoring
Boiler Ash	Concrete and asphalt caps
Glue Press Waste	No additional action
Solvent Tank Area	No additional action
Offshore Sediments	Land use restrictions and long-term monitoring

2.1.1 Entire Site and Offshore Sediments Operable Units

Land use restrictions can be physical measures and legal or administrative mechanisms. Physical measures, such as fences and signs, limit access to the site and activities that could damage the cap. The legal mechanisms may be either an agreed order or other agreement between Ecology, Champion, SBT, and Coastal.

Land use restrictions for the entire site operable unit include limiting site access and prohibiting use of site groundwater as a drinking water source. Land use restrictions for the entire site also limit disruption of the asphalt/concrete cap over the boiler ash material. Land use restrictions for offshore sediments prohibit disturbing the material to reduce the possible availability of contaminants to aquatic species and limit human contact with potentially hazardous constituents.

Site access restrictions will be accomplished with the use of "No Trespassing" signs at the site. In addition, an agreement between Ecology and the potentially liable parties (PLPs) will be implemented to limit unnecessary activities in the offshore sediments area that may disturb or provide access to the sediments.

Section 4.0 describes the long-term monitoring for the entire site, including the offshore sediments.

Land use restrictions in the entire site operable unit will also address concerns of possible methane accumulation in new facilities at the site. This will be accomplished through review of future construction plans (by an engineer registered in the State of Washington) and evaluation of possible problems associated with methane accumulation (i.e., explosive environments or asphyxiation hazards). Specific actions that may be implemented if potential problems are identified include:

- Installation of continuous monitoring devices to identify potentially explosive environments
- Design of buildings that would facilitate ventilation of the sub-floor areas
- Installation of blowers to increase the flow of air and reduce potential methane accumulation.

These restrictions would be implemented through an order or agreement between Ecology and the PLPs.

2.1.2 Boiler Ash Operable Unit

The cap for the boiler ash operable unit consists primarily of a 6-inch concrete layer and a 3-inch asphalt covering in the vicinity of the existing boiler house (Figure 2-1). The cap protects human health by reducing the opportunity for contact with potentially hazardous subsurface materials. Laboratory analyses of the fill material are summarized in the RI/RA/FS report (Kennedy/Jenks/Chilton 1991).

The concrete extends from the north face of the boiler house to the southern edge of the concrete dock (Figure 2-1). The asphalt covers the surface area between the western edge of the boiler house to the wood dock and extends to the opening between the two wood docks (Figure 2-1). A more detailed illustration of the cap design is presented in Figure 2-2.

The concrete and asphalt are underlain by six inches of 5/8-inch minus-crushed rock. The concrete contains welded wire fabric to control cracking from temperature deformations. The subgrades are compacted to 95 percent of maximum density as described in Section 2-06.3(1) of the Seattle Standard Specifications for Road, Bridge, and Municipal Construction ("Standard Specifications") (City of Seattle 1989). The western and northern edges of the asphalt cap are supported by concrete footings to prevent edge cracking.

The cap generally matches the existing grade to minimize excavation. However, in some areas, some surface materials must be removed, while in other locations additional sub-base materials are required.

The cap surfaces are sloped approximately one percent to drain all surface water to two catch basins located on the western edge of the asphalt pavement (Figure 2-2). The catch basins have sufficient capacity to allow debris, oil, and grease to separate from the stormwater before the stormwater discharges directly to Salmon Bay.

In addition to draining the pavement, the southern catch basin collects water from three downspouts of the former boiler building. These downspouts drain precipitation from the western edge of the former boiler building (approximately 1,825 square feet of surface area).

2.2 ENGINEERING JUSTIFICATION AND DESIGN CRITERIA

The containment features of the remedial action were prepared in accordance with the engineering requirements outlined in the following City of Seattle Engineering Department documents:

- Design Specifications for Private On-Site Drainage Systems, Publication Number 225, revised March 1992

- City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction, 1989

- City of Seattle Standard Plans for Municipal Public Works Construction, Twelfth Edition, 1991 ("Standard Plans").

A brief discussion of how the site conditions could affect the containment system and the engineering justification for design elements is presented below.

2.2.1 Site Conditions

- Flooding: This site is not subject to flooding because the U.S. Army Corps of Engineers controls the level of Salmon Bay. The upper limit of the lake is 9.02 feet, which is well below the lowest elevation of the project (approximately 11.7 feet).

- Seismic activity: An earthquake would not be a catastrophic event for the containment components. Damaged concrete, asphalt, or stormwater system elements can be repaired or replaced.

- Temperature extremes: The relatively mild Pacific Northwest climate is not expected to damage the concrete or asphalt. The concrete contains

welded wire fabric to control cracking caused by thermal expansion and contraction. The asphalt is flexible and can sustain temperature-caused movement. An adequate maintenance program can detect and repair cracks caused by temperature changes.

- Vehicular damage: A routine operations and maintenance program will provide an adequate mechanism for detecting and repairing spalls, chips, cracks, and potholes.

- Relationship of cap to existing facility operations: The cap can support low to moderate levels of vehicular traffic that could use the facilities in and around the dock and boiler house area.

- Shoreline management issues: According to the City of Seattle Department of Construction and Land Use, a Shoreline Substantial Development Permit will be required for implementation of this project (Welner, C. 30 April 1992, personal communication).

- Soil characteristics: The subgrade is a sandy, well-compacted material that is currently supporting vehicular traffic (i.e., light trucks and passenger cars).

- Groundwater system: Groundwater appears to be only a few feet below the surface (Kennedy/Jenks/Chilton 1991). Buoyancy could become a factor for the catch basins. Appendix A presents calculations showing that the catch basin weight is sufficient to overcome the buoyancy force.

- Methane gas: The RI/RA/FS (Kennedy/Jenks/Chilton 1991) reported that subsurface organic material is producing methane gas. If methane gas is produced beneath the cap, it will migrate vertically to the base of the cap, travel horizontally to the cap edges then dissipate to the atmosphere. We

do not anticipate a potentially explosive buildup of methane gas beneath the cap.

- Stormwater discharge: Stormwater may be discharged directly to receiving waters such as the Salmon Bay. [Seattle Engineering Department (SED) Publication 225 (page 19)].

2.2.2 Engineering Justification for Design Elements

- Subgrade preparation: Standard Specifications Section 2-06 outlines standards for subgrade preparation.

- Sub-base, concrete, and asphalt thicknesses: Standard Plans 402.1A and 401.1D specify sub-base and surfacing material thickness.

- Asphalt and concrete mix design: The City of Seattle recommends Portland cement concrete [i.e., 3,000 per square inch (psi) concrete using six cement sacks per cubic yard and maximum aggregate size of 1.5 inches] and Class B asphalt. Materials standards are outlined in Standard Specifications Sections 5-05.2 and 5-04.2 for concrete and asphalt, respectively.

- Catch basins: The catch basin described in Standard Plan 241.1a is used for areas covering less than 7,500 square feet [SED Publication 225 (page 4)].

- Pipe slope: The minimum pipe slope is 2 percent [SED Publication 225 (page 13)].

- Depth of cover: The minimum depth of cover for pipe is 18 inches. Additional cover is added to protect against crushing. [SED Publication 225 (page 14)].

- Pipe material: The service drain pipe material is polyvinyl chloride (PVC) meeting ASTM D 3034 SDR 35 requirements [Standard Specifications Section 9-05.12 and SED Publication 225 (page 14)].

- Pipe bedding: The pipe bedding conforms to Standard Plan 285.1C and referenced Standard Specifications.

- Pipe size: Four-inch stormwater collection pipe is permitted when no more than three downspouts are connected [SED Publication 225 (page 12)]. Appendix A contains calculations to verify that a 4-inch pipe is adequate for a 25-year storm event.

2.3 SHORT- AND LONG-TERM PROTECTION OF HUMAN HEALTH

The short-term protection of human health concerns implementation of the remedial action. Long-term protection involves the ongoing period beginning with the completion of the cap. The RI/RA/FS for the site (Kennedy/Jenks/Chilton 1991) reported that inadvertent ingestion and dermal absorption were the exposure routes of concern. The remedial action did not consider inhalation to be an exposure route because the boiler ash is covered by three feet of clean fill and is located in saturated soil conditions.

2.3.1 Short-Term Protection

Short-term protection of human health involves risks associated with the hazardous constituents in the boiler ash and risks typically related to construction activities.

The boiler ash is not likely to present unacceptable risks to human health during construction. The clean fill layer provides a barrier in most instances to the underlying contaminated medium. However, installation of the catch basins may expose workers to hazardous substances in the underlying boiler ash. Remediation workers will use personal protective equipment to reduce the risks involved with handling the hazardous boiler ash. This equipment is identified in Section 4.4. If cap installation results in visible dust, the contractor will lightly water the area. Watering will also be used to reduce fugitive dust during other earth-moving operations.

The contractor will decontaminate equipment used to install the catch basins. Decontamination will consist of rinsing the equipment, catching the runoff, and characterizing it. Material excavated to install the catch basins will be placed in suitable containers and characterized. The contractor will dispose of all waste materials in accordance with applicable federal, state, and local laws and regulations.

This remedial action involves activities typically associated with construction sites that could pose risks to human health. These activities include working around moving heavy equipment, tripping and falling hazards, lifting heavy objects, and handling potentially dangerous materials (e.g., hot asphalt pavement). These are typical construction risks that the contractor can manage with a comprehensive health and safety plan.

2.3.2 Long-Term Protection

With proper maintenance, the cap will provide adequate long-term protection of human health. The cap will reduce the potential for dermal contact with or inadvertent ingestion of hazardous constituents in the boiler ash. The cap will minimize the potential for migration of the constituents through erosion, thereby

protecting aquatic organisms. The cap will reduce the ability of surface water to leach heavy metals from the boiler ash and transport them to Salmon Bay.

This alternative also includes land use restrictions for the entire site, including the boiler ash area. Land use restrictions for the entire site will minimize activities that could damage the cap or cause exposure to contaminants in the subsurface soil. The restrictions also will alert current and future property owners to the need for adequate health and safety measures for any activities occurring in contaminated locations.

This remedial action does not require design features (e.g., pressure valves, bypass systems, safety cutoff switches) to assure the long-term safety of site workers or nearby residents.

2.4 APPLICABLE FEDERAL AND STATE REQUIREMENTS

This section describes how the remedial action meets applicable federal and state requirements. Table 2-2 presents the requirements and a brief description of how the remedial action meets them.

2.5 CONSTRUCTION SCHEDULE

Table 2-3 presents steps needed to complete the remedial action and an estimate of the schedule.

TABLE 2-2

APPLICABLE FEDERAL AND STATE REQUIREMENTS

Citation	Description	Requirement	Remedial Action Attainment
40 CFR[a]122.26(b)(14)	Stormwater discharges	NPDES[b] permit required if stormwater discharge from parking lots is mixed with stormwater from regulated areas.	Stormwater from remedial action area does not commingle with regulated stormwater.
WAC 173-201	Surface water quality standards	Stormwater discharges to Salmon Bay must meet surface water standards.	Catch basins allow for separation of undesirable constituents such as oil and grease. Routine cleaning of catch basins will likely help to meet standards.
WAC 173-340-360(8) and (9)	MTCA[c] requirements for containment actions	Containment requires long-term monitoring. Describes Ecology expectation that containment is required for low levels of hazardous constituents where treatment is impracticable.	Long-term monitoring is included. Cap is appropriate for site conditions (i.e., low levels of hazardous constituents that cannot be practically treated).
WAC 173-303 or WAC 173-304	Dangerous Waste Regulations Minimum Functional Standards	Excavated material and decontamination water must be stored, treated, and/or disposed of in accordance with these regulations.	Characterization of wastes to determine proper handling methods.
WAC 173-16	Shoreline Management Act regulation	Shoreline activities must meet local requirements for protection and use of shoreline areas.	Complete Shoreline Substantial Development Permit and submit to City of Seattle DCLU.[d]
WAC 296-62	General Occupational Health Standards	Guidelines for protection of workers.	Development of health and safety plan addressing hazards associated with site chemicals and dangers associated with construction.

NOTES:

(a) Code of Federal Regulations
(b) National Pollutant Discharge Elimination System
(c) Model Toxics Control Act Cleanup Regulation
(d) City of Seattle Department of Construction and Land Use

TABLE 2-3

CONSTRUCTION SCHEDULE

Activity	Months[a]
Develop land use restrictions	6
Obtain necessary permits • Drainage Permit - Seattle Engineering Department • Shoreline Substantial Development Permit - DCLU	12
City of Seattle Engineering Department review	12
Bidding and awarding contract	15
Completion of remedial action	18

NOTES:

(a) Time from Ecology approval of this document.

N

SALMON BAY

DNR BOUNDARY

APPROXIMATE PROPERTY BOUNDARY

APPROX. SHORELINE AT HIGH WATER MARK

EXISTING WHARF

FORMER LOG MILL POND AREA

EXISTING WHARF

WAREHOUSE

FORMER 1,000 GALLON UNDERGROUND STORAGE TANK

W. EWING ST.

13TH AVE. W.

RESIN MIX TANK

OFFICE BUILDING

FACTORY BUILDING

FACTORY BUILDING

WAREHOUSE

WAREHOUSE

WEST NICKERSON STREET

GLUE RESIN STORAGE TANK

APPROXIMATE DREDGE AREA

BOILER HOUSE

PCP STORAGE/ EXCAVATION AREA

APPROXIMATE BOILER ASH FILL AREA

FORMER LOCATION OF DRYERS

SOLVENT TANK AREA
(FORMER UNDERGROUND TANK LOCATION)

BALLARD BRIDGE

15TH AVE. WEST

LEGEND

ASPHALT CAP

CONCRETE CAP

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.
2. MAP SOURCE: JAY SPEARMAN, CONSULTING ENGINEER, 11/20/89.

APPROXIMATE SCALE:

0 50 100FT

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SEATTLE, WA

APPROXIMATE LOCATION OF CAP

916016.02/P2SK002

FIGURE 2-1

3.0 PLANS AND SPECIFICATIONS

Plans and specifications for the remedial action at the Champion site are presented in Figure 2-2.

4.0 COMPLIANCE MONITORING PLAN

This section describes the objectives, locations, and methods for compliance monitoring activities that will be performed at the Champion site as a result of remedial actions identified in the CAP. Compliance monitoring activities identified in this section will fulfill requirements for ongoing monitoring of this cleanup action in accordance with MTCA (Chapter 173-340-410 WAC).

4.1 OBJECTIVES AND SCOPE

The primary objective of this Compliance Monitoring Plan (CMP) is to fulfill the specific requirements for long-term monitoring established by MTCA and provide sufficient information to perform periodic review in accordance with Chapter 173-340-420 WAC. As identified in Section 2.0, the remedial action for the site includes the following.

- Installation of an asphalt and concrete cap in the boiler ash operable unit over the upland portions of the site where boiler ash materials have been identified.

- Land use restrictions for the entire site operable unit, which includes prohibiting use of groundwater in the solvent tank area, minimizing disturbance of the boiler ash cap, and evaluating future building plans to identify potential explosive environments. The remedial action also includes installing no trespassing signs and prohibiting access to the property.

- Land use restrictions in the offshore sediments operable unit includes sampling of the offshore sediments every five years.

As outlined in Chapter 173-340-410 WAC, compliance monitoring has three main objectives.

- The first, protection monitoring, is intended to confirm that human health and the environment are protected during implementation of the remedial action [Chapter 173-340-410(1)(a) WAC].

- The second component, performance monitoring, is used to verify that the cleanup action has attained established cleanup requirements [Chapter 173-340-410(1)(b) WAC].

- The final component is confirmational monitoring which confirms the long-term effectiveness of the cleanup action [Chapter 173-340-410(1)(c) WAC].

These objectives are addressed below.

4.1.1 Protection Monitoring

Because all potential contaminant sources at the site are generally inaccessible (i.e., boiler ash is covered with 3 feet of sand, and offshore sediments are below water in an industrial area), adverse impacts to workers, the surrounding community, or the environment appear to be minimal. Therefore, specific monitoring to assess possible human health or environmental impacts to the site or surrounding area will not be performed during remediation. To reduce potential contact with contaminants, site workers implementing the remedial action will have 40-hour health and safety training and will use appropriate health and safety equipment (Section 4.4).

4.1.2 Performance Monitoring

Because the remedial action does not include treatment of the wastes and because chemically impacted media will be left in place, performance monitoring is not appropriate for the site. The effectiveness of the cap over the boiler ash sediments will be evaluated through annual inspection and maintenance.

4.1.3 Confirmational Monitoring

Confirmational monitoring will be appropriate to assess changing conditions that may occur in the offshore sediments. The specific activities that will be performed are discussed below.

4.2 CONFIRMATIONAL MONITORING - SAMPLING AND ANALYSIS PLAN

The following sampling and analysis plan (SAP) will be implemented at the Champion site. These activities will provide adequate information to assess changing conditions in the offshore sediments.

4.2.1 Sampling Locations, Frequency, Chemical Analyses, and Procedures

Sampling locations and chemical analyses will follow the same approach used during the RI/RA/FS. As previously discussed, this approach will help assess changing site conditions.

4.2.1.1 Sampling Locations. During the RI/RA/FS, offshore sediment samples were collected at three general locations within the Lake Washington Ship Canal (Ship Canal). These include the Ship Canal channel, the Washington Department of

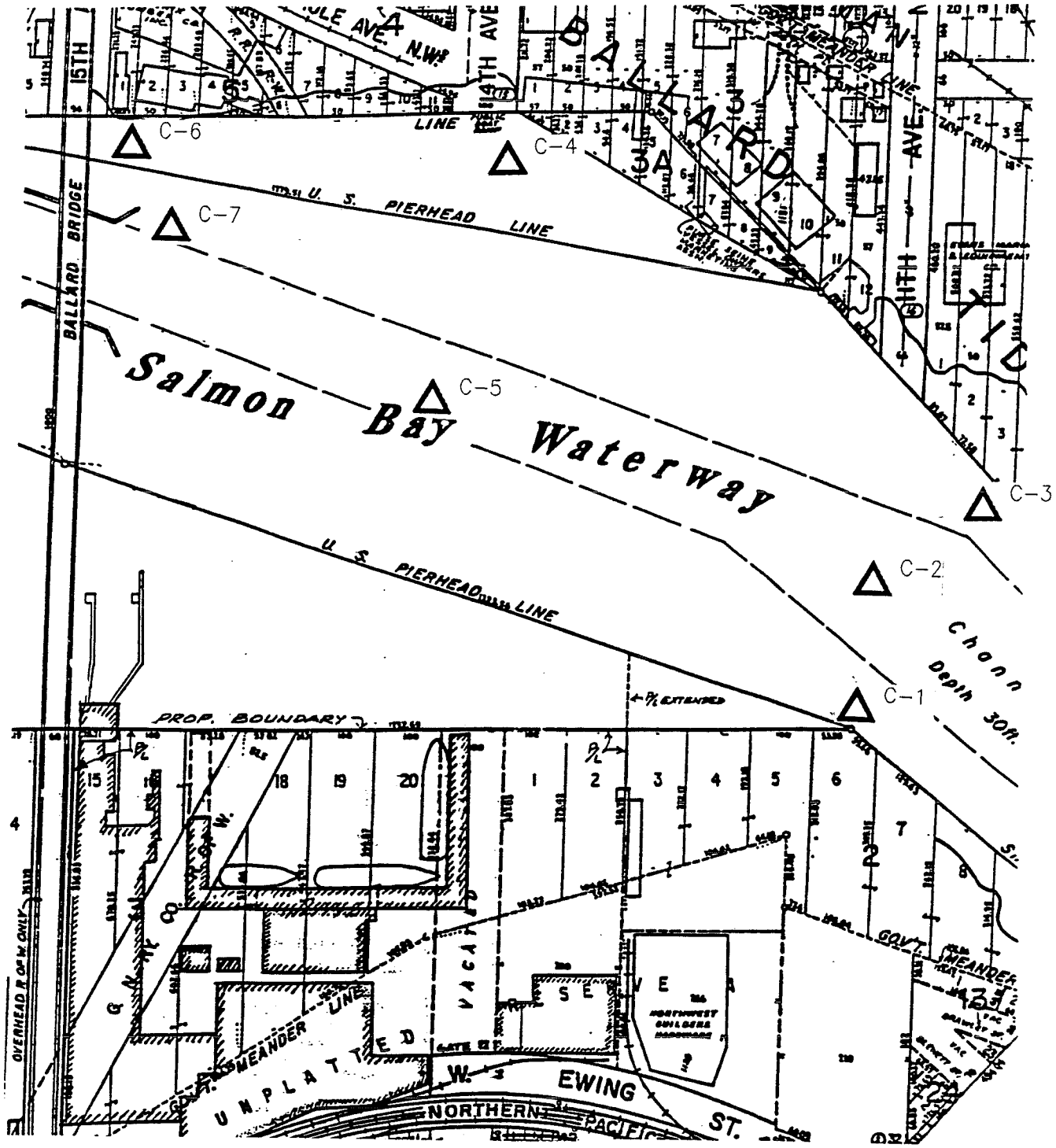
Natural Resources (DNR) lease areas, and the areas below former and existing onsite buildings. These sampling locations are shown on Figures 4-1 and 4-2.

During confirmational monitoring, sediment sampling will be performed at these same locations. As indicated, a total of 19 locations will be sampled. Seven of the sampling locations are in the Ship Canal channel, six locations are in the DNR lease area, and the remaining six are below the former and existing onsite buildings (Figures 4-1 and 4-2). This sampling approach was selected because it will provide a means to assess whether varying chemical concentrations in sediments are reflective of local loading sources.

Sediment samples will be collected in a 4-foot sample tube and homogenized in the analytical laboratory performing the analyses. As a result, the sample collected should be representative of chemicals occurring on the surface of the sediments as well as at depth.

Confirmational monitoring sampling activities will be performed at a frequency of once every five years starting in 1996 (i.e., approximately five years after the RI/RA/FS was performed). If after two sampling periods, contaminant concentrations in sediments are below cleanup levels, then confirmation monitoring would be discontinued.

4.2.1.2 Chemical Analyses. During performance of the RI/RA/FS, sediment samples were analyzed for a wide array of chemical and geotechnical parameters. Analyses performed during a confirmational monitoring will focus on only those chemicals that were detected consistently during previous sampling events and evaluated in the RA and FS. Therefore, sediment sample analysis will be limited to selected metals (i.e., 13 Priority Pollutant metals), semivolatile organic compounds (SVOC) analyzed by EPA Method 8270, and total petroleum hydrocarbons (TPH) analyzed by EPA Method 418.1 and EPA Modified Method 8015 (as diesel). All samples will also be analyzed for total volatile solids (EPA Method 160.4) and for



LEGEND

△ C-7 LAKE WASHINGTON SHIP CANAL SEDIMENT SAMPLING LOCATION.

0 100 200 300 400 500

APPROXIMATE SCALE

Kennedy/Jenks Consultants

CHAMPION INTERNATIONAL CORP.
SEATTLE, WA

SEDIMENT SAMPLING LOCATIONS IN LAKE WASHINGTON SHIP CANAL

916016.02/P2SK003

FIGURE 4-2

total organic carbon (Standard Methods 5310B) to assist in comparison with applicable freshwater sediment criteria, when available.

To assess the reproducibility of sample results, one duplicate sample will be collected at each of the three sediment sampling areas (i.e., Ship Canal channel, DNR lease area, and below the former and existing onsite buildings).

4.2.1.3 Sampling Procedures. Sediment sampling in the Ship Canal channel and in the DNR lease area will likely be performed with the use of a ship or barge. Sediment samples collected below the former and existing onsite buildings will be collected from a small boat or through openings in the building floor. Sediment samples will be collected with a 4-inch aluminum sediment core sampler with a sediment catcher. The sampler will be advanced with a manually-operated drop hammer. If this sample collection method is not feasible, samples may be collected with the aid of a Van Veen grab sampler. Two clean 1-liter jars will be filled at each sampling location. All sediment samples will be stored on ice until submittal to the analytical laboratory.

Between sampling locations, the sampler will be disassembled and washed in a solution of phosphate-free laboratory soap and triple rinsed in distilled water. To assess potential cross-contamination between sampling rounds, one rinsate blank will be collected within each of the three sampling units (i.e., Ship Canal channel, DNR lease area, and below the former and existing onsite buildings).

4.3 QUALITY ASSURANCE ACTIVITIES

Quality assurance activities will be the same as those outlined in the Quality Assurance Plan (QAP) submitted for performance of the RI/RA/FS (Kennedy/Jenks/ Chilton 1989). Data quality objectives will be the same as those established in the QAP.

4.4 HEALTH AND SAFETY

Health and safety procedures that will be followed during implementation of the remedial action and during confirmational monitoring will be the same as those identified in the Site Health and Safety Plan prepared for the RI/RA/FS (Kennedy/Jenks Chilton 1989). Site workers involved in the installation of the cap over the boiler ash sediment will have 40-hour health and safety training and will wear Level D personal protective equipment (PPE). Level D PPE includes the following.

- Tyvek suits or cloth overalls, hard hat, steel-toed work boots, leather gloves, safety glasses, and ear protection, if warranted.

In addition, site workers will be advised not to eat, drink, or smoke as work is being performed.

N

SALMON BAY

DNR BOUNDARY

APPROXIMATE PROPERTY BOUNDARY

D-1

D-2

D-3

D-4

D-5

D-6

B-1

B-2

B-3

B-4

B-5

APPROX. SHORELINE AT HIGH WATER MARK

EXISTING WHARF

EXISTING WHARF

FORMER LOG MILL POND AREA

OFFICE BUILDING

RESIN MIX TANK

WAREHOUSE

W. EWING ST.

13TH AVE. W.

WEST NICKERSON STREET

FACTORY BUILDING

FACTORY BUILDING

WAREHOUSE

WAREHOUSE

GLUE RESIN STORAGE TANK

BOILER HOUSE

APPROXIMATE BOILER ASH FILL AREA

FORMER LOCATION OF DRYERS

BALLARD BRIDGE

15TH AVE. WEST

LEGEND

D-3 SEDIMENT SAMPLE LOCATIONS

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.
2. MAP SOURCE: JAY SPEARMAN, CONSULTING ENGINEER, 11/20/89.
3. REFER TO FIGURE 4-2 FOR SEDIMENT SAMPLING LOCATIONS IN THE LAKE WASHINGTON SHIP CANAL.

APPROXIMATE SCALE:

0 50 100FT

Kennedy/Jenks Consultants

CHAMPION INTERNATIONAL CORP.
SEATTLE, WA

CONFIRMATIONAL MONITORING OFFSHORE SEDIMENT

916016.02/P2SK004

FIGURE 4-1

5.0 OPERATIONS AND MAINTENANCE

This section describes the operations and maintenance plan for the Champion site. The operations and maintenance plan describes the steps necessary to maintain the integrity of the asphalt and concrete cap. The plan also describes the actions needed to minimize the possible discharge of oil, grease, and debris into Salmon Bay from the catch basins.

The cap functions primarily as a barrier to prevent human contact with underlying hazardous materials. Consequently, small cracks that typically develop in these materials will not significantly increase the risk to human health. However, an engineer will examine the cap annually to determine if maintenance is required. The owner will make repairs in the following instances:

- Spalls, chips, or other damage reveal the imbedded welded wire fabric (in the concrete cap)
- Cracks exceed one-eighth inch in width and appear to migrate through the entire thickness of the cap material
- The underlying sub-base material is exposed
- The sub-base or subgrade fails
- The pavement edges deteriorate or are damaged
- Other situations that, in the opinion of the engineer, warrant action.

Repairs to cap components will conform to the Standard Specifications (City of Seattle 1989).

The catch basins will be cleaned out quarterly for the first year of operation. The cleanout period can be changed to a reduced frequency (e.g., semiannually or annually) if, in the opinion of the engineer, the reduced frequency will not degrade the quality of the stormwater discharge.

In addition, the engineer will examine other components of the remedial action system, including catch basins, discharge pipes, and downspout connections.

The engineer will give the owner a written report describing the inspection and required repairs within 30 days of completing the inspection. The owner will complete the engineer's recommended actions within 30 days of receiving the report.

6.0 REFERENCES

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Appendix A

Design Calculations

APPENDIX A
DESIGN CALCULATIONS

A. Determine buoyancy force on catch basins.

1. Buoyancy force is equal to the volume of displaced water.

2. The catch basin has dimensions of 32 in x 28 in x 57 in and a thickness of 4 in. See Standard Plan 241.1a.

3. Assume density of concrete is 150 pounds/cubic foot (lbf/cf)

4. Calculate weight of catch basin.

   a. Base: (32 in x 28 in x 4 in) x 5.787E-4 cf/cubic inches (ci) = 2.07 cf

      2.07 cf x 150 lbf/cf = 311 lbf

   b. Vertical portion of basin:

      [(32 in x 28 in x 57 in) - (24 in x 20 in x 57 in)] = 23,712 ci

      23,712 ci x 5.787E-4 cf/ci = 13.7 cf

      13.7 cf x 150 lbf/cf = 2,058 lbf

   c. Total weight of catch basin = 311 lbf + 2,058 lbf = 2,369 lbf (not including the catch basin lid or steel reinforcement). Soil friction is not considered.

5. Determine buoyancy force.

   a. Base of catch basin is at 6.1 feet. High-water mark in Salmon Bay is 9.02 feet (see Standard Plan 001). Volume of displaced water is then

      32 in x 28 in x [(9.02 ft - 6.1 ft) x 12 in/ft] = 31,396 ci

      31,396 ci x 5.787E-4 cf/ci = 18.2 cf

      18.2 cf x 62.4 lbf/cf = 1,134 lbf

6. Weight of catch basin is much greater than buoyancy force.

   2,369 lbf > > 1,134 lbf

7. Conclusion: Catch basins will not float.

B. Verify correct size of collection pipe (assume 4 inches).

1. Downspouts collect stormwater from roof top that drains 1,825 square feet (sf) [73 ft x 25 feet (center line of door marks the location of roof ridge line].

2. Use 25-year intensity frequency duration curve for Seattle-Renton (King County 1979).

3. Use rationale formula Q = ciA where

   Q = flow in cubic feet per second (cfs)

   c = runoff factor

   i = intensity of storm event in inches/hour (in/hr)

   A = area of drainage in acres (ac)

4. Let

   c = 0.9 for pavement and roof tops (Pierce County 1986)

   i = 2.7 in/hr

   A = 1,825 sf/43,560 sf/ac = 0.042 ac

5. Then

   Q = 0.9 x 2.7 in/hr x 0.042 ac = 0.102 cfs

6. Use $K^1 = \frac{Qn}{D^{8/3}\ 5\frac{1}{2}}$

   At a slope of 2%, $5\frac{1}{2}$ = 0.1414

   D = 4″ $\quad D^{8/3} = \left(\frac{4}{12}\right)^{8/3}$ = 0.0534

   Required Q_{req} = 0.102 cfs, check for actual Q_{peak}

   n = Assume 0.009

   For a full flow pipe, K^1 = 0.4631

$$0.4631 = \frac{Q_{peak}\ (0.009)}{(0.0534)\ (0.1414)}$$

$$Q_{peak} = \frac{(0.4631)\ (0.0534)\ (0.1414)}{0.009} = 0.389 cfs$$

$$Q_{peak} >> Q_{required}$$

7. Conclusion: 4-inch collection pipe is adequate (0.389 cfs > > 0.102 cfs).