

STAFF REPORT

For

**FORMER NICHOLS BOAT WORKS
HOOD RIVER, OREGON**



Prepared By

OREGON DEPARTMENT OF ENVIORNMENTAL QUALITY
Eastern Region Cleanup Program
Bend Office

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1. INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

This document presents a summary of work conducted for soil, sediment and groundwater investigations at the former Nichols Boat Works facility (Nichols), in Hood River, Oregon (Figure 1-1). The work was completed by Oregon Department of Environmental Quality (DEQ) and Nichols contractors under DEQ oversight through the Orphan-Site Response Program in accordance with Oregon Revised Statutes (ORS) 465.200 through 465.455, and Oregon Administrative Rules (OAR) 340-122-010 through 340-122-115. This report summarizes the more detailed information contained in several reports completed under a DEQ agreement between Nichols and DEQ. A copy of the Administrative Record Index is attached as Appendix A.

Nichols completed a Remedial Investigation (RI) with supporting documents in 2005 and 2006. An Interim Removal Action Measure (IRAM) for upland soil and near-shore sediment was completed in the fall of 2006. A final IRAM Report was completed in March 2007 documenting the results of the removal, which included a human health risk assessment screening and ecological risk assessment screening based on environmental conditions following performance of the IRAM.

The purpose of this Staff Report is to document the DEQ's selected remedial action for the facility. The selected remedy is summarized in Section 6.

2. SITE HISTORY AND DESCRIPTION

2.1 SITE LOCATION AND LAND USE

The subject property is located immediately northeast of Interstate 84 (I-84), Exit 63 in Hood River, Oregon (see Figure 2-1). The property lies between I-84 and the Columbia River on North Second Street (Tax Lot 100 and 200, Section 25, Township 3N, Range 10E). The site is situated on approximately 5.23 acres at the south end of a horseshoe-shaped marina that is adjacent to the confluence of the Hood River and the Columbia River.

2.2 PHYSICAL SETTING

2.2.1 Surface Water Hydrology

The site is bounded on the north by the Columbia River while the Hood River is located immediately east of the site, separated by a dike. The site is relatively protected within the basin. The average river stage height fluctuates between approximately 72 and 75 feet above mean sea level (msl).

The current sediment profile of the basin is characterized by a history of extensive dredge and filling activities from the 1960's and from movement of various boats within the inlet. Recent flooding of the Hood River in the fall of 2006 has resulted in the deposition of 750,000 cubic yards of sediment while increasing the size of the bar to approximately 26 acres. This flooding has essentially shut off access of the boat basin adjacent to the site with the Columbia River. Recent meetings with the Army Corps of Engineers (ACOE) and the Port of Hood River have indicated that dredging this opening is currently a low priority. The most recent dredging within the basin occurred in 1992 by the ACOE.

A recent hydrographic survey of the basin indicates the basin itself (beyond the boat ways) is relatively flat and averages between 56 and 59 feet above msl.

2.2.2 Geology and Hydrogeology

The property is situated in the Columbia Gorge National Scenic Area, which has an underlying base of thick basalt flows. The existing Hood River waterfront was created for industrial use by extensive dredge filling during the 1960s and the site rests on dredged fill material and natural alluvial deposits. Site soils are gravels, fine sands, and sandy silts. The site topography slopes gently toward the Columbia River. It should also be noted that the existing land surface is comprised of primarily dredge sands deposited in the area in the late 1960's/early 1970s and does not represent undisturbed conditions.

While groundwater investigations did not install permanent monitoring wells, several other sites in the area have had monitoring wells installed, and shallow groundwater flow is normally anticipated to flow toward and discharge to the Columbia River. Shallow groundwater fluctuations from changes of the Columbia River pool height and the stage of the Hood River are also anticipated to affect the shallow groundwater flow conditions at the site.

It is also likely that the Hood River stage provides influence on the shallow groundwater in the area; the flow of groundwater is from the Hood River toward the site or the Columbia River, hence the Hood River is upgradient of the site and any site conditions would not impact the Hood River.

Deeper groundwater aquifers in the area are used to provide drinking, irrigation, and commercial sources of water. Deeper groundwater movement is described in several documents, and is in general, north toward the Columbia River in this area (USGS 1981, 1984).

2.3 Beneficial Land and Water Use Determination

2.3.1 Current and Reasonably Likely Future Land Use

The site was located within an area zoned by the City of Hood River as "Industrial Use" based on zoning maps obtained from the city (City of Hood River 2006a). Recent rezoning requests in December 2006 have been approved to rezone the property to General Commercial (C-2) which permits retail, office, hotel, restaurant and residential uses (City of Hood River 2006b).

Future land use at the Nichols site is not certain, but given recent discussions with the new property owner, the location is likely to be redeveloped for some mixed use commercial and residential (NBW Hood River LLC 2007).

A launching site for windsurfers and other recreational users is located adjacent to the site at the end of the dike/spit at the mouth of the Hood River. Kite-boarders, water-skiers, and other users have also been observed using the water in the basin adjacent to the site.

The current and reasonably likely anticipated future land use of the Nichols site and adjacent properties is recreational and commercial.

2.3.2 Current and Reasonably Likely Future Beneficial Water Use

A determination of beneficial uses of groundwater is required per OAR-340-122-080. Shallow groundwater from this site discharges to the adjacent Columbia River, while residences and businesses in the vicinity are hydraulically upgradient and generally supplied by city water. There are no current on-site uses of groundwater at the Nichols site. Drinking water is supplied to the area of the subject property by the City of Hood River, which obtains its water from the Cold/Stone spring system about 15 miles southwest of Hood River, near Lost Lake (ODHS 2007).

A search of well logs in the immediate vicinity was conducted using the Oregon Water Resources Department (OWRD) database to confirm this assumption. While there are several shallow monitoring wells for environmental investigations at other sites in the database, there was no water wells in the vicinity of the site that were recorded in the database. However, in discussions with the Port of Hood River, there is a deep well present northwest of the site that has been used to provide water. Subsequent documentation indicated that this well may be misidentified in the database (Port of Hood River 2007).

The OWRD records list 6 wells used for irrigation or industrial purposes within the survey area (Sections 25 and 30). The wells range in depth from 71 to 400 feet below ground surface (bgs). The closest well, as identified by the Port of Hood River, is 71 feet deep and is approximately 700 feet northwest of the site and has been identified as supplying water for boat washing and possible other non-potable uses.

Local groundwater at the site discharges directly into the Columbia River to the north. The nearest residences and businesses are hydraulically upgradient and are supplied by a municipal water source. Hence, it is not a reasonable assumption that shallow groundwater at the site may be used for human consumption.

The reasonably likely future beneficial use is recharge to surface water and recharge to deeper water-bearing zones that may be used for drinking water supply. Due to the vertical distance and lithology to the next (deeper) water-bearing zone, it is very unlikely that the impacted shallow aquifer will adversely affect those beneficial uses. In addition, DEQ has administrative authority to institute deed restrictions on groundwater use at a site, if this is deemed necessary for the project.

Accordingly, the highest beneficial use of shallow groundwater originating at the site, per OAR-340-122-080, is support of aquatic life via surface water recharge.

2.3.3 Surface Water Beneficial Use Determination

The primary beneficial use of the Columbia in the area of the site is habitat for ecological receptors including resident fish and aquatic habitat. Other beneficial uses of the Columbia within the area include possible fishing, hunting, boating, water contact recreation, and aesthetic quality. There is no current direct public access to the river from the property, but it has been identified as a likely future use based on adjacent properties and observed use.

There is only one surface water right in the vicinity. It is located on Adams Creek, approximately ½-mile southeast of the site and is used for irrigation.

There are also two in-stream water rights in the Hood River for minimum flows to the Columbia River.

2.4 Site History and Operations

Areas close to the current property had been used as a shipbuilding and ship repair facility by the Nichols family since 1941. The current location of the boat building facility had been in use since the 1970's. Onsite operations have been idle since 1998. The property contains submerged acreage adjacent to an access channel owned by the Port of Hood River

Shipbuilding and repair activities included steel hull construction, steel rolling, welding, painting, and sandblasting. Sandblasting occurred mostly on clean steel hulls, but may have periodically included removal of paint from hulls. The types of vessels built and repaired at the site included tugboats, towboats, large volume barges for hauling wood chips and grain, ferries, fishing boats, and a tourist sternwheeler. Nichols completed more than 360 jobs between 1941 and 1998. Some jobs involved oversized vessels that could not fit inside the workshop.

Prior to the industrial use by Nichols, and other waterfront facilities, the basin served as a boat marina for privately owned vessels. According to company Vice-President Robert Nichols, the basin also included a floating Texaco gas station. Additionally, two historic gas stations were located near the southwest corner of the basin in the 1960s and 1970s. One of the gas stations was destroyed during a fire.

3. INVESTIGATION SUMMARY

3.1 Previous Investigations

3.1.1 Dredge Investigations

The ACOE conducted sampling in 1991 at three discrete locations in the surface sediments along an access channel in the Port of Hood River before it was dredged. Sample results indicated arsenic, cadmium, and mercury at or above the DEQ Level II Screening Level Values (SLVs) published in 2001. Chrysene, a PAH, was detected above the SLV as well. While information on the work is vague, the locations of the samples exceeding the SLVs may have been dredged and disposed of by the ACOE.

3.1.2 Technical Assistance Site Investigation

On July 28, 1992 DEQ completed a site investigation of the Nichols Boat Works property in response to a pollution complaint filed concerning possible illegal disposal of waste (DEQ 1992). On the southeastern corner of the property, drums and pails containing spent sandblast grit and waste bilge water were stored. Some of the containers had no lids. The material was sampled and analyzed for heavy metals toxicity characteristic leaching procedure (TCLP), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and total petroleum hydrocarbons (TPH). Results of analyses showed barium, lead, methyl ethyl ketone, benzene, total cresols and TPH were present.

3.1.3 Marina Sediment Characterization

In 1998 the Port of Hood River hired a private contractor to collect samples from six locations in the marina (EnviroScience 1998). The samples were analyzed for TCLP metals, VOCs, TPH and extractable organic halogens. According to the contractor's report, "None of the samples were considered contaminated based on United States Environmental Protection Agency (EPA) and Oregon standards." The only detection was barium at less than 1 milligram per Liter (mg/L).

3.1.4 DEQ Site Assessment High Priority Ranking

In 1999, DEQ's Eastern Region Site Assessment program identified the Nichols property as a
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potential site of concern based on long term shipbuilding and repair activities, proximity to surface water (Columbia River and Hood River) used for contact recreation and by endangered species (salmon) and local newspaper articles indicating possible redevelopment interests.

During 2000 and 2001, DEQ made initial inquiries to the site owners and performed limited site visits. Additionally in 2001, DEQ received verbal and written complaints regarding rust-colored foam in the marina. On March 19, 2002, DEQ collected a composite sample from the drought-exposed shoreline. The visibly stained (rust and reddish in color) material was collected in the vicinity of the boat launching ways, to the east of the ways and to the southeast corner of the marina. The composite sample contained arsenic at 155 milligrams per kilogram (mg/kg) and chromium at 431 mg/kg. Two background samples were collected from an exposed bed in the Columbia River, north of the site. Arsenic was reported at <0.20 mg/kg in both samples, and chromium was detected at 4.46 mg/kg and 5.15 mg/kg, respectively. Based on the property owner's inability to pay for cleanup expenses, coupled with the high priority ranking by the DEQ, the site was referred to the DEQ's Orphan Cleanup group for further evaluation and possible remedial actions.

3.1.5 Site Investigation and Report

In March 2003, Ecology and Environmental Inc. (E & E) under contract with the DEQ, conducted a formal site study to investigate the extent to which site media are affected by chemicals of potential concern (COPCs). The results of the site investigation showed that surficial soils (0-2 feet) were impacted with metals and shallow groundwater and sediments were impacted by metals and poly aromatic hydrocarbons (PAHs). Generally, the metal detections in soil and sediment were highest in and around the boat ways and other areas of former sandblasting activity (E&E 2003).

3.1.6 Tier I and II Ecological Evaluation, Level II Screening Risk Assessment

On August 25, 2003, DEQ staff visited the site to photo document the site's conditions and complete Tier I and II Ecological Evaluations (DEQ 2003). Based on the habitats at the site, the observed presence of ecologically important species and the presence of COPCs, DEQ concluded that exposure to ecological receptors was possible and that a Level II Screening Risk Assessment was necessary. Based on likely land and water uses, DEQ determined potentially complete exposure pathways and receptor combinations for:

- Sediments and surface waters (aquatic organisms and recreational users); and
- Soils (on-site users and terrestrial organisms).

The Level II Screening Assessment was performed using data collected during the prior site investigations (DEQ 2001; E & E 2003).

Soil results generally indicated that surface soils contained higher concentrations of metals than subsurface soils. Of the retained COPCs identified, arsenic, chromium, lead, nickel and zinc posed a relatively greater potential risk due to the number and relevancy of SLVs that were exceeded (DEQ 2003). Groundwater data suggested contamination may be localized in one or more specific areas. Aluminum and copper were presumed to pose the greatest potential ecological risks. In sediment, PAHs (with the exception of 2-Methylnaphthalene and Acenaphthylene) and heavy metals including antimony, arsenic, cadmium, chromium, copper, lead and zinc, posed the greatest potential risk.

3.2 Remedial Investigation Summary

In June 2005, PBS under contract with Mr. Bob Nichols, conducted a DEQ-approved RI. The purpose of the RI was to further delineate the extent of contamination related to boat work activity in the upland portion of the site and in the boat basin immediately to the north. The results of the RI indicated certain metals and PAHs in excess of SLVs were detected in nearshore sediments underneath 1.5 feet of relatively clean sediment. Additionally, shallow groundwater, encountered between 4 and 17 feet below surface, and upland soils were impacted by metals and PAHs. Metals in groundwater that exceeded the surface water SLVs for aquatic receptors were not found to be present in pore water or surface water samples (PBS 2005).

Generally, detections in soil and sediment were highest in and around the two boat ways and other areas of former sandblasting activity. Figure 3-1 shows the locations of soil, sediment, and groundwater samples. A summary of the results are briefly described below.

3.2.1 Upland Soil

It was determined from the previous investigations that the extent of contamination in upland soils was confined to approximately 2 feet bgs and that the COPCs were limited to metals.

Soil samples results were screened against EPA Region 9 Preliminary Remediation Goals (PRGs) for residential soils and Oregon DEQ Risk-Based Concentrations (RBCs) for soil ingestion and soil leaching to groundwater (lead only). Based on DEQ conclusion of very limited upland habitat for terrestrial species, the ecological SLV for invertebrates was used.

In general, concentrations were similar to the background sample collected by E & E in 2003. Aluminum, chromium, copper, nickel and zinc were detected in all soil samples while antimony and lead were only detected in two samples. Arsenic and cadmium were not detected in any soil samples. Aluminum and chromium levels exceeded the ecological SLVs, while none of the sample results exceeded human health screening criteria. Past sampling results have indicated relatively high background concentrations of aluminum in soil at approximately 3,800 mg/kg and results at the site are not likely attributable to boat works operations. These factors suggest that some metal concentrations may be naturally occurring, not attributable to former boat works operations. DEQ's evaluation of several of the metal contaminants of concern suggest that the natural

background concentrations for aluminum (~15 wt % or ~7,900 g), in particular are not attributable to Nichols Boat Works (USGS 1987). Chromium was considered the relevant contaminants of concern (COC) for the site.

The results of the RI indicated that metals content in upland soils generally did not exceed human health screening criteria, excepting metals in those areas of concentrated, visible sand-blast sand.

3.2.2 Groundwater

Shallow groundwater samples were collected from several locations at the site. Shallow groundwater samples were analyzed for total and dissolved metals. It was determined from the previous investigation that the groundwater COPCs were limited to metals. Groundwater concentrations of chromium and lead concentrations appear elevated, especially within the source areas of black grit near the boat ways. The remainder of the groundwater results were within acceptable risk based criteria or less than the background levels for the area

Based on DEQ's conclusion that the highest beneficial use of groundwater is in support of aquatic life, groundwater results were compared to ecological SLVs for aquatic receptors in surface water, and found to exceed those SLVs.

Porewater and surface water testing also did not detect metals in excess of the SLVs, therefore groundwater contaminants do not appear to be adversely impacting surface water. As a result, all exposure pathways related to groundwater are considered incomplete.

Levels of metals in groundwater also do not exceed current DEQ RBCs for construction or excavation workers.

3.2.3 Sediment

Sediment samples were collected by divers within the boat basin/inlet. Discrete samples were collected from the surface of the sediment to a depth of approximately 6 inches below the surface to 1.5 feet below the sediment surface. It was determined from the previous investigations that the sediment COPCs were limited to metals and PAHs.

Surface sediment samples were analyzed for SVOCs and metals. Detections were screened against SLVs for freshwater sediment. As a way to evaluate sediment exposure risk to "recreational users" of the inlet, results were also compared to residential soil PRGs and/or DEQ RBCs for residential direct contact with soil.

In general, metal concentrations were highest in the nearshore sediment samples and decreased away from the boat launch way. Where pairs of samples were tested, from both 0.5 feet and from 1.5 feet below surface, the deeper sample generally contained higher levels of metals. Metals content at

1.5 feet contained the largest number of metals exceeding either ecological or human health screening levels.

The only SVOCs detected were PAHs at a depth of 1.5 feet below surface. While some of the PAHs exceeded SLVs and only benzo(a)pyrene exceeded the human health PRG for residential soil exposure, the highest levels were found beneath a 1.5 feet clean surficial layer

Based on the detections of metals and PAHs in the sediment; additional sediment was retained at each location for bioassay toxicity testing. The two sediment samples that generally exhibited the highest COPC concentrations and one of the background samples were selected for the toxicity tests. According to the bioassay evaluation criteria provided in the Dredge Material Evaluation Framework for the Lower Columbia River Management Area, Appendix 9-B (1998), little or no toxicity was shown in the samples.

3.2.4 Porewater

Porewater samples were collected from 4 nearshore sediment samples. The porewater samples were analyzed for dissolved metals. Results were screened against surface water SLVs for aquatic receptors. Dissolved aluminum, chromium, copper and lead were detected in porewater. Only dissolved aluminum exceeded the SLV screening criteria. Dissolved metal detections in porewater were generally less than or equivalent to upland groundwater metals.

3.2.5 Surface Water

Surface water samples taken in front of the boat launch ways were analyzed for total and dissolved metals. The results were compared to surface water SLVs for aquatic receptors. Total aluminum, copper, lead and dissolved copper were detected in SW-2. Only dissolved aluminum exceeded the SLV screening criteria. All surface water metals detections were less than porewater and groundwater results.

3.3 Locality of Facility Determination

Based on the results of the investigation, the locality of the facility (LOF) is located in upland soil and adjacent in-water sediments and is primarily confined to the boat basin (Figure 3-1). Groundwater discharging to surface water and sediment also falls within the LOF. The Hood River is not within the LOF, which would include those areas to which contaminants may reasonably be expected to be transported or migrate.

4. INTERIM REMOVAL ACTION MEASURES

4.1 Identified Areas of Concern

The most significant onsite contamination appeared to be in the form of black sandblast grit concentrated in surface soil and near shore sediment. The location of the black grit was found to be inside of the boat shop and along the boat launch ways which extended to below the water surface. In addition, there were distinct zones where green sandblast grit was identified in surface soil to the northeast of the boat shop. Less significant areas of concern included detections in groundwater east of the boat shop and in deeper sediments within the boat basin which are currently buried beneath cleaner sediment.

4.2 Upland Soil and Sediment IRAM

Nichols implemented an IRAM to remediate primarily elevated concentrations of metals in soil and sediments near the Columbia River shoreline. Aluminum, antimony, arsenic, cadmium, chromium, copper, lead, nickel and zinc were the primary metal COPCs.

The removal was completed during the week of December 4, 2006 with the boat shop and boat ways in place. Cleanup extended approximately 4 feet beyond the mean high water line as a result of a request by the property owner to the ACOE to drop the Columbia River pool height/stage. The water level was lowered to approximately 71.5 feet msl.

The soil and sediment removal occurred in a phased approach utilizing the dig and haul method with x-ray fluorescence (XRF) field screening and confirmation sampling and laboratory analysis for COPCs. The soil was stockpiled until enough material was collected for truck loading. For proper disposal determination, a TCLP test was performed on a representative sample of the material to be removed. The material qualified to be disposed at Wasco County Landfill, a Subtitle D solid waste facility.

The cleanup work was conducted under a Nationwide Permit under Section 404 of the Clean Water Act. The 404 Permit issued by the ACOE and Oregon Division of State Lands (DSL) served as the regulatory mechanism for soil and sediment removal activities. Nichols Boat Works was the permit applicant and approval was granted from the ACOE and DSL.

The Oregon State Historical Preservation Organization (SHPO) was contacted regarding potential buried artifacts in and around the Property. A database search revealed no specific concern for the possibility of buried artifacts onsite. The Oregon SHPO gave a “cautionary” warning to be on the look out for any buried artifacts during cleanup activities.

A total of approximately 1,000 tons of material was removed and disposed of during the IRAM removal and resulted in the removal of a significant amount of soil and sediment from the site. Confirmation sampling was conducted following the IRAM removal to assess the soil and sediment contaminant concentrations following the removal. Figure 4-1 shows the IRAM removal areas and location of confirmation samples collected following the removal.

4.2.1 Contaminant Reduction

Concentrations of metals associated with the site were reduced by approximately 3 to 80 percent from pre-removal concentrations (Table 4-1). Aluminum, antimony, arsenic, cadmium, chromium, copper, lead, nickel and zinc were the metals posing the greatest risk prior to the soil and sediment removal. The average concentration for each of these metals was significantly reduced during the IRAM.

5. HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENTS

5.1 Conceptual Site Model

Current development plans call for a hotel, restaurant and marina. Recreational users such as water skiers and boaters have been observed using the boat inlet and likely will continue to make use of the area. Therefore, the exposures of recreational users to surface water and residential receptors exposed to upland soil are considered complete pathways. Additionally, soil related impacts transported by surface water to near shore sediments may come into contact with recreational users and aquatic organisms and is considered a pathway. And it is expected the future use of the site will be in some way utilized by the public.

Following the Oregon DEQ Risk-Based Decision-Making guidance document, potential pathways of exposure to human and ecological receptors were evaluated (DEQ 2006). The assessment approaches explicitly addresses potential risks to construction, excavation or remediation workers.

The investigation did not identify a significant subsurface risk and since soil and sediment concentrations are below residential PRGs (PBS 2005). Upland soil contamination is limited to the surface soils and near shore sediment. Potential proposed development in the water may disturb sediment present below the surface and will be evaluated if and when plans are finalized.

5.1.1 Potential Pathways of Exposure

There are a variety of potential exposure pathways via *direct contact, ingestion or inhalation* of surface soils. Generally, soil impacts are present at the surface to approximately 6 inches below ground surface and concentrations substantially decrease with depth.

Contaminants of interest are certain heavy metals and PAHs, therefore there is not a risk due to soil or groundwater contaminants that may *volatilize to indoor or outdoor air*. It has been demonstrated that low levels of contaminants have impacted shallow groundwater, therefore the potential for soil contaminants *leaching to groundwater*, and resultant exposures, must be considered.

Exposure pathways related to groundwater use, i.e. *ingestion and inhalation from tap water*, are considered incomplete because no water wells are located within ½ mile of the subject property, municipal water is readily available for the subject property and surrounding areas and the

underlying aquifer is not currently or reasonably likely to be used in the future. Drinking water is supplied to the area of the subject property by the City of Hood River.

Exposure to contaminated groundwater, occurring from 4 to 17 feet below surface, may be a risk to future *construction or excavation workers*, particularly nearer the shoreline. The potential for *groundwater to discharge to surface water* presents additional exposure routes.

Potentially complete routes of human and ecological exposure are:

- *Ingestion, dermal contact or inhalation (surface soils, subsurface soils, groundwater, surface water or sediment)*
- *Soil leaching to groundwater; and*
- *Groundwater discharge to surface water*

5.1.2 Potential Receptors

Potential human receptors include construction and excavation workers (soil or groundwater *inhalation, dermal contact*); transients (soil exposure pathways); residential and commercial occupants, and public recreation (soil, sediment or surface water exposure pathways).

Because of poor existing habitat and relative inaccessibility of the site, the upland portion of the site is not expected to provide significant habitat for terrestrial species except possibly those with limited habitat needs (e.g. insects and annelid worms). The nearshore portion of the site is inhabited by woody species, grasses, cottonwood trees and freshwater clams at the rocky shoreline. Shorebirds and ducks have been seen in this area. It has been determined that the inlet at Nichols Boat Works could be used by various life stages of Salmonid species for feeding or refuge (DEQ 2003).

5.2 Human Health Risk Screening

A screening level assessment conducted by comparing soil and sediment concentrations to EPA PRGs determined that no measured concentrations at the site exceeded conservative residential criteria. The current upland soil was already protective of residential exposure prior to the IRAM. The implemented IRAM helped to reduce any additional loading to sediment and confirmation sampling post-removal indicates that the site is still protective of human health.

The results of the RI indicated that heavy metals and PAHs content in upland soils generally did not exceed human health screening criteria, except in those areas of concentrated, visible sand-blast grit.

Upland soil and nearshore sediment were subsequently removed during the IRAM implemented in December 2006. While the implemented IRAM helped to remove the visible sand blast grit and reduce any additional loading from the soil to sediment, confirmation samples from the upland and near-shore areas indicates that levels of arsenic remain that exceed human health RBCs. These areas are representative of the sandblast grit storage areas and represent possible leaching from the near surface soils that were removed. Soil samples from below 4 feet bgs do not exceed the construction

and excavation worker exposure risk based scenarios (Table 5-1).

Levels of heavy metals in groundwater do not exceed current DEQ RBCs for construction or excavation workers (Table 5-2). In addition, the removal of surface contaminants is expected to reduce the source of loading to groundwater and therefore further decrease concentrations of COCs in groundwater.

5.3 Ecological Risk Screening

A Phase II ecological risk assessment indicated that DEQ SLVs were exceeded that are protective of benthic organisms. The results showed that some metals and PAHs exceeded these conservative screening levels, although PAHs were not detected in subsequent confirmation sampling events. Concentrations and therefore, potential risks were highest at the nearshore near the boat ways and showed a trend of concentrations decreasing outward into the bay to the north. To determine if these exceedances were biologically meaningful and could actually be resulting in toxicity to benthic organisms, PBS performed toxicity bioassays at 2 locations at the nearshore where concentrations were highest (PBS 2005). The results of these tests did not indicate that sediments were toxic to the benthic organisms.

Upland soil and nearshore sediment were subsequently removed during the IRAM implemented in December 2006. Confirmation samples from the upland and near-shore areas indicates that levels of aluminum and chromium remain that exceed the ecological SLVs for invertebrates, and in places copper and zinc slightly exceed the SLVs (Table 5-1).

Based on the relatively small size and restricted access to the site, freeway and road on two sides and Columbia and Hood Rivers on the other two, DEQ believes that any significant use of this site by terrestrial mammals is unlikely, especially given future development plans. Notwithstanding, the likelihood of site access, it should also be noted that OAR 340-112-0115 and DEQ risk assessment policy for non-threatened and endangered species is to protect the species population, not every individual organism.

As previously discussed, the highest beneficial use of groundwater is in support of aquatic life. Groundwater results were compared to ecological SLVs for aquatic receptors in surface water, and found to exceed some SLVs. Porewater and surface water testing, however, did not detect metals in excess of the SLVs, therefore groundwater contaminants do not appear to be adversely impacting surface water. As a result, all exposure pathways related to groundwater are considered incomplete.

Results of confirmation sampling below the mean high water line demonstrated successful removal of site-specific COPCs to below the DEQ SLVs for freshwater sediment. The remaining in-water zone of contamination that was not accessible is overlain by a 1.5-foot thickness of cleaner sediment. Based on a presumed zone in sediment of biological activity to 1.5 feet in depth, remaining contaminants below that depth do not present a risk to aquatic inhabitants.

Additionally, most metals, with the exception of arsenic and cadmium, and PAHs with the exception of pyrene, are not considered bioaccumulative (DEQ 2007). Therefore, given the absence of demonstrated toxicity, the limited spatial extent of impacted sediment, the absence of bioaccumulation potential for most of the COPCs, and the expected reduction in groundwater loadings, the available evidence does not suggest a potential for unacceptable ecological risks.

5.4 Uncertainty Evaluation

This section discusses the uncertainty in the risk estimates for both the soil exposure of future workers or residents. Possible uncertainty regarding ecological exposure to terrestrial mammals and the fish ingestion pathway are also evaluated

Given future development plans for the site, the likelihood of soil exposure is low. Timely development of the site will reduce any potential pathway, access restrictions will prevent exposure until that timeframe, and the soil and sediment management and contingency plans proposed for the site will address future uncertainties.

Based on a zone in sediment of biological activity of approximately 1.5 feet in depth, remaining contaminants below that depth do not present a risk to aquatic inhabitants. With respect to sediment contamination, an important assumption has been made, that the 1.5-foot thickness of overlying clean sediment lying near the shoreline not be disturbed without precautions to minimize mobilization of the contaminated zone and to properly dispose of such sediment that may be excavated.

It is possible that the site could be occasionally visited by aquatic mammals (e.g., Beaver or Otter), although we do not know if this actually occurs or with what frequency. DEQ did screen water concentrations to aquatic-life criteria protective of fish and other water column organisms, but no soil or sediment-based criteria are available assess potential effects to aquatic mammals directly, although it is theoretically possible to estimate food web exposures to aquatic mammals for some organic chemicals.

DEQ believes based on likely fisheries and our understanding of current and likely future land and water uses, that exposures to site-related substances from consumption of locally captured or collected aquatic foods is likely to be minimal. Therefore, DEQ has focused assessment efforts on what we believe to be the most potentially significant risk pathways at this site. If human consumption becomes part of the scope of work for future evaluation, ground or surface water concentrations could be compared to relevant criteria as a screening level evaluation.

DEQ may look at revisiting the sediment screening against additional applicable human health based criteria where pathways are complete, as appropriate, and that some concerns (i.e., fish and shellfish

consumption) could potentially be addressed by comparison of concentrations in groundwater to Ambient Water Quality Criteria (AWQC).

Several studies show that PAHs do not accumulate in fish, but are rapidly metabolized in the liver. Half-lives for elimination of PAHs in fish ranged from greater than 2 days to 9 days. The model used to derive PAH concentrations in fish tissue does not account for metabolism of PAHs, but rather assumes that they continue to bioaccumulate.

The PAHs identified in sediments are thought to be associated with the petroleum-based products that may have been used in the boat manufacturing process, from the historic operation of floating gas stations, the operation of a marina, or from other anthropogenic sources previously identified in the area of the Columbia River (ACOE 1991).

5.5 HOT SPOT DETERMINATION

As specified in OAR 340-122-080(7), an evaluation was conducted to identify hot spots of contamination in media other than water. OAR 340-122-115(31)(b) defines as hot spots media other than water where hazardous substances are present in concentrations greater than:

- 100 times the acceptable risk level for human exposure to each individual carcinogen;
- 10 times the acceptable risk level for human exposure to each individual non-carcinogen; or
- 10 times the acceptable risk level for exposure of individual ecological receptors or population of ecological receptors to each individual hazardous substance.

A hot spot may also be identified where hazardous substances are reasonably likely to migrate to such an extent that they have a significant adverse effect on beneficial uses of groundwater or surface water.

As summarized in the previous sections, upland soil does not pose an unacceptable exposure risk to human health or ecological receptors that would be identified as a hot spot of contamination at the site.

6. SELECTED REMEDIAL ACTION

As a result of site characterization and remedial action, the former Nichols Boat Works site presents a low risk of exposure to residual contaminants in surface soil and buried sediment. Pre-removal and post-removal comparisons of data generally indicate the reduction of contaminants through direct removal was successful. Possible ingestion, dermal contact, or inhalation of soil contaminated with arsenic for a residential or construction worker have been identified as possible risk scenarios for the site.

6.1 SELECTED REMEDY

On the basis of the investigation and IRAM conducted to date, a combination of institutional controls and engineering controls has been selected for the site to ensure protectiveness of human health and the environment. Because of uncertainties associated with the possible development along the shoreline and deep detections of COPCs beneath clean layers of sediment a Soil and Sediment Management Plan and Contingency Plan will be developed for the site to allow for changes that may affect the overall protectiveness of the site conditions.

6.1.1 INSTITUTIONAL CONTROLS

An Easement and Equitable Servitude (E&ES) will be placed on the site to prohibit water well installations without prior DEQ approval.

6.1.2 ENGINEERING CONTROLS

Future development of the site will include a mixed use residential/commercial type development. The development will include areas that will be completed as walkways, parking, and buildings which will act as an impermeable cap to prevent direct contact with remaining soils, prevent on site soils from migrating off the parcel toward the water, and provide for reduced infiltration of precipitation. In addition, a Soil and Sediment Management Plan and Contingency Plan will be developed for the site to address future issues that may arise with the site development plans.

6.1.3 SOIL AND SEDIMENT MANAGEMENT PLAN

As a result of site characterization and remedial action, the Nichols site presents a low risk of exposure to residual contaminants in surface soil and buried sediment. A Soil and Sediment Management Plan will be created to guide future work at the site, including demolition, site preparation and new construction.

6.1.4 CONTINGENCY PLAN

If redevelopment plans involve modification of the shoreline with disturbance of deeper sediments, a Contingency Plan will be developed and submitted for approval by DEQ that describes how contaminated sediments will be managed while maintaining protective conditions at the site.

6.2 RESIDUAL RISK ASSESSMENT

OAR 340-122-084(4)(c) requires a residual risk evaluation of the recommendations that demonstrates that the standards specified in OAR 340-122-040 will be met, namely:

- Assure protection of present and future public health, safety, and welfare, and the environment
- Achieve acceptable risk levels
- For designated hot spots of contamination, evaluate whether treatment is reasonably likely to restore or protect a beneficial use within a reasonable time
- Prevent or minimize future releases and migration of hazardous substances in the environment

As a result of site work, the following potential exposure risks remain:

- Possible ingestion, dermal contact, or inhalation of remaining soil due to elevated concentrations of arsenic for possible residential receptors and construction workers.
- With respect to sediment contamination, an important assumption has been made, that the 1.5-foot thickness of overlying clean sediment lying near the shoreline not be disturbed without precautions to minimize mobilization of the contaminated zone and to properly dispose of such sediment that may be excavated; and

The Contingency Plan will be used to address potential future issues identified at the site, while the Soil and Sediment Management Plan will be used to manage and dispose of any contaminated material.

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6.3 PEER REVIEW SUMMARY

Technical documents produced during the investigation of the LSD area site have been reviewed by a technical team at DEQ. The team consists of the project manager/hydrogeologist, and a toxicologist. The team unanimously supports the selected remedial action.

6.4 PUBLIC NOTICE AND COMMENT

The public notice and comment (PNC) period for the recommended remedial action at the Nichols site occurred during the month of April. The PNC was placed in the Oregon Secretary of State's Bulletin and in the Hood River Newspaper. There were no comments received by DEQ on the remedy.

6.5 CONCURRENCE

State of Oregon,
Department of Environmental Quality

By: _____ Date: _____

Joni Hammond

Administrator, Eastern Region

Appendix A

ADMINISTRATIVE RECORD INDEX

Former Nichols Boat Works Facility Hood River, Oregon

The Administrative Record consists of the documents on which the recommended remedial action for the site is based. The primary documents used in evaluating remedial action alternatives for the Nichols site are listed below. Additional background and supporting information can be found in the Nichols project file located at DEQ Eastern Region Office, 300 SE Reed Market Road, Bend, Oregon.

SITE-SPECIFIC DOCUMENTS

Army Corps of Engineers 1991, Sediment Quality Summary Report, Minimum Operating Pool Sediment Evaluation, September/October 1991.

City of Hood River 2006a, Zoning Map. Dated 6/14/2006

City of Hood River 2006b, City Council Notes, Quasi-Judicial Zone Change, August 31, 2006.

Oregon Department of Environmental Quality (ODEQ) 1992, Pollution Complaint Investigation, Prepared by DEQ Hazardous Waste, July 28, 1992

DEQ 2001, Pollution Complaint Investigation, Prepared by DEQ Hazardous Waste, November 14, 2001

DEQ 2002a, Strategy Recommendation [Report], Prepared by Dan Crouse, Site Assessment Section, Land Quality Division, Oregon DEQ, May 15, 2002.

DEQ 2002b. Public Notice to Secretary of States Bulletin and The Oregonian newspaper. June

DEQ 2002c, Orphan Site Declaration, Prepared by Oregon DEQ, August 2002

DEQ 2002d, Nichols Boat Works Fact Sheet, December 2002, Prepared by Oregon DEQ, December 2002

DEQ 2002d, October 28, 2002, DEQ Internal Memo on Default Background Concentrations for Metals.

DEQ 2003, Tier I and II Ecological Evaluation and Level II Ecological Risk Assessment, Prepared by Oregon DEQ, September 2003

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DEQ 2006a, Response to Columbia River Keeper Comments, , Comments on Proposed Interim Removal Prepared by DEQ, April 20 ,2006

DEQ 2007. Guidelines for assessing bioaccumulative chemicals of concern in sediment. Oregon Department of Environmental Quality, Environmental Cleanup Program. January 31, 2007.

EnviroScience 1998, Chemical Evaluation of Boat Basin Sediments, Columbia River @ Hood River, Oregon, Prepared by EnviroScience, Inc., November, 1998

EPA 1992, Ground Water Issue Paper, Behavior of Metals in Soils EPA/540/S-92/018, October 1992

Flowing Solutions 2007, Andrew Jansky, Public Meeting Slide Presentation, February 13, 2007.

Ecology & Environment, Inc., (E & E) 2003a, Site Investigation Work Plan, February 2003

E & E 2003, Final Site Investigation Report, September 2003b

PBS Engineering and Environmental, Inc., (PBS) 2005, Remedial Investigation Report

PBS 2005b, Remedial Investigation Addendum.

PBS 2006a, Interim Removal Action Measure Work Plan.

PBS 2006b, Nichols Site Nationwide Permit, Section 404, No. 38 (Cleanup of Hazardous and Toxic Waste), United States Army Corps of Engineers, Oregon Department of State Lands, October 2006.

PBS 2007, Removal Action Report: Upland Soil Removal, March 2007.

Port of Hood River 2007, Meeting with DEQ, February 14, 2007.

NBW Hood River LLC 2007, Meeting with DEQ, February 14, 2007.

Oregon Department of Health Services (ODHS) 2007, Drinking Water Program Inventory, <http://oregon.gov/DHS/ph/dwp/>

United States Geological Survey (USGS) 1981, Ground-Water Resources in the Hood Basin, Oregon WRI 81-1108.

USGS 1984, A Description of Aquifer Units in Eastern Oregon, WRI-84-4095

USGS 1987, Geologic Map of the Hood River Quadrangle.

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Figure 1-1

Figure 2-1

Figure 3-1

Figure 4-1

Table 4-1

Table 5-1

Table 5-2