**McDowell Rackner & Gibson PC**

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October 25, 2013

**VIA ELECTRONIC FILING AND FIRST CLASS MAIL**

PUC Filing Center
Public Utility Commission of Oregon
PO Box 1088
Salem, OR 97308-1088

**Re: Docket UG 263 – NORTHWEST NATURAL GAS COMPANY, dba NW NATURAL, Investigation into Prudence of Gasco Site Capital Costs.**

Enclosed for filing in the above docket are an original and five copies of NW Natural's Direct Testimony of Alex Miller and Robert Wyatt.

A copy of this filing has been served on all parties to this proceeding as indicated on the enclosed Certificate of Service. Please contact this office with any questions.

Very truly yours,

Wendy McIndoo

Wendy McIndoo
Office Manager

Enclosure

## CERTIFICATE OF SERVICE

I hereby certify that I served a true and correct copy of the foregoing document in Docket UG 263 on the following named person(s) on the date indicated below by email addressed to said person(s) at his or her last-known address(es) indicated below.

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DATED: October 25, 2013

Wendy McIndoo
Office Manager



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419 SW 11th Avenue, Suite 400
Portland, OR 97205

BEFORE THE

PUBLIC UTILITY COMMISSION OF OREGON

**UG 263**

**NW Natural**

**Direct Testimony of C. Alex Miller**

**RECOVERY OF GASCO SOURCE CONTROL SYSTEM COSTS**

**EXHIBIT 100**

October 2013

# EXHIBIT 100 –TESTIMONY OF C. ALEX MILLER – GASCO SOURCE CONTROL SYSTEM

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Rates & Regulatory Affairs
**NW NATURAL**
220 N.W. Second Avenue
Portland, Oregon 97209-3991
1-503-226-4211

## I. INTRODUCTION AND SUMMARY

**Q. Please state your name and position with NW Natural Gas Company ("NW Natural" or "the Company").**

A. My name is C. Alex Miller. My current position is Treasurer and Vice President of Regulation for NW Natural. I am responsible for Rates & Regulatory Affairs, as well as Treasury operations.

**Q. Please summarize your educational background and business experience.**

A. I received a B.A. in economics from the University of Oregon in 1980. I received an M.B.A. from Claremont Graduate School in 1984. From 1981 through 1997, I worked at Southern California Edison in various rate and finance positions, including Vice President and Treasurer. From 1997 to 2001, I worked at PacifiCorp in various positions, including Vice President of Business Development. I joined NW Natural in 2003. Since 2005, I have been a member of the environmental steering committee at NW Natural, a group of executives and managers that monitors and helps in decision-making regarding NW Natural's ongoing environmental remediation activities and cost recovery efforts.

**Q. What is the purpose of your testimony?**

A. NW Natural's filing is being made pursuant to the Prudence and Earnings Test Stipulation entered into by the parties in UM 1635, and which was filed on July 11, 2013 ("Stipulation"),[1] and the Administrative Law Judge's Prehearing Conference Memorandum and Ruling issued in UM 1635 dated October 11, 2013 (ALJ's Ruling). In the Stipulation, the parties came to an agreement as to, among other things, the

[1] The parties filed Joint Testimony supporting the Stipulation on August 7, 2013.



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appropriate methods for recovery of the capital costs associated with constructing a water treatment plant at the Company's Gasco site ("Gasco Source Control").[2] Pursuant to that agreement, on September 6, 2013, the Company filed testimony addressing the prudence of the Gasco capital costs and requesting a finding of prudence in time for the costs to be recovered in the upcoming PGA that will be implemented on November 1, 2013. However, the Public Utility Commission of Oregon ("Commission") has not yet ruled on the Stipulation, and the parties to the Stipulation have requested additional time to perform the prudence review. For these reasons, the parties proposed and the ALJ adopted a different procedure for review and recovery of the Gasco capital costs. First, the parties agreed that the Company would make an advice filing to recover the Gasco costs incurred up to the time when the plant became operational, limited to the amount NW Natural estimated in its September 6th testimony ($19,048,300). The parties agreed that the costs would be subject to refund to the extent any costs were found by the Commission to be imprudent. That filing, Advice 13-21, is set to be considered at the Commission's regularly scheduled Public Meeting on October 28, 2013; if approved, those costs will be included in rates through this year's PGA. Second, the Commission has opened this docket, with the limited scope of reviewing the prudence of Gasco site project costs. As described above, in the event that any portion of the costs is disallowed, the Company will make an appropriate refund to customers.

Thus, the purpose of my testimony is to describe the Stipulation and other agreements among the parties with respect to the Gasco Source Control project, and to

[2] In the Stipulation, the parties referred to the project as the "Gasco Pumping Station."



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explain how the Company proposes that insurance and other third-party proceeds should be applied to offset the Gasco Source Control costs.

**Q. Please summarize your testimony.**

A. In my testimony I will:

- Describe the parties' agreement as to the appropriate treatment of the capital costs associated with the construction of Gasco Source Control, and the process for recovery of those costs; and
- Present the Company's proposal for the appropriate application of any insurance proceeds (or other third-party recoveries) to be applied to the Gasco Source Control capital costs.

**Q. Is the Company providing any other testimony in support of its request?**

A. Yes. The Company is also providing the testimony of Robert Wyatt in support of its request. Mr. Wyatt's testimony will explain why the Company was required to construct the Gasco Source Control system, describe DEQ's oversight of the process, and will present the costs for which recovery is requested. This testimony is similar to Mr. Wyatt's testimony filed on September 6, 2013, but has been updated and expanded to provide additional detail as requested by the parties.

## II. STIPULATED TREATMENT OF GASCO SOURCE CONTROL COSTS

**Q. Please provide some background for the parties' Stipulation with respect to the Gasco Source Control costs.**

A. In NW Natural's last general rate case—UG 221—the Company proposed that the Commission adopt a mechanism for the recovery of its costs to remediate environmental impacts associated with its historic manufactured gas plants (MGP). Specifically the



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Company asked for approval of a Site Remediation Recovery Mechanism (SRRM) through which past deferred and future costs would be tracked and included in rates over a five-year amortization period, through the PGA process. However, the Company requested a different treatment for the capital costs associated with the construction of the Gasco Source Control. Specifically, the Company proposed that once that project was complete, the project costs be treated as an addition to rate base, to allow amortization over a longer period of time, matching more closely the expected life of the facilities.[3]

**Q. Did the Commission approve NW Natural's requested treatment for the costs to construct the Gasco Source Control?**

A. No. The Commission found that the request was premature given that the project had not yet been constructed. Accordingly the Commission stated: "When the plant is completed, the company may seek cost recovery through the SRRM or through inclusion of the plant in rate base in a future rate proceeding."[4]

**Q. Did the Company raise the issue again in UM 1635?**

A. Yes. In UM 1635, the Company clarified that it had never intended to request that the Gasco Source Control costs be added to rate base *before* the investments were made or judged prudent—only that the Commission adopt a rate base treatment for the costs that would be applied *after* the project was in service and the costs had been judged prudent. Given that the Company expected the project to be complete by the end of the third quarter of 2013, the Company hoped to secure approval of the process, which could

[3] UG 221, NWN/1500, Miller/18.
[4] Order No. 12-437, p. 32.



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then be carried out coincident with the PGA process. Additionally, the Company was hoping for clarity with respect to the appropriate accounting for the costs of the Gasco Source control—given that it did not have certainty under the Commission's order in UG 221 whether it should account for the costs as capital (appropriate for rate base treatment) or whether it should include the capital costs in the deferred amounts eligible for recovery through the SRRM.

**Q. Did the Stipulation address NW Natural's request?**

A. Yes. In Paragraph 15 of the Stipulation the parties agreed that:

(a) The capital costs associated with the Gasco Source Control will be evaluated for prudence following its completion—which is expected by the end of the third quarter of 2013;

(b) If the Commission determines that the costs associated with the Gasco Source Control were prudently incurred, those costs will be included in base rates at the same time as the first subsequent Purchased Gas Adjustment; and

(c) The parties will work collaboratively to determine the extent to which any insurance amounts received should be applied against the amounts of rate base included in base rates for the Gasco Source Control.

**Q. Will the ongoing operations and maintenance costs of the Gasco Source Control also be added to rate base?**

A. No. By its terms, Paragraph 15 of the Stipulation applies only to the capital (construction) costs associated with the Gasco Source Control. The ongoing costs to



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operate and maintain the project will be recovered through the SRRM, as described in the Final Order issued in UG 221,[5] and not added to rate base.

**Q. Is the Gasco Source Control complete and operational?**

A. Yes.

## III. REQUEST FOR RECOVERY

**Q. Has the Company incurred the capital costs estimated in its September 6th testimony?**

A. Yes. The Company has incurred at or above the level of costs than those estimated in the September 6th testimony. However, in accordance with the agreement among the parties, NW Natural will only collect through this year's PGA an amount based on the capital costs that were estimated in the Company's September 6th testimony.[6]

**Q. Is the Company requesting a prudence determination in this filing for all of the capital costs associated with getting Gasco Source Control operational, or just the costs that were forecast to be spent?**

A. The Company is requesting a prudence review for all of the Company's actual costs of getting the Gasco Source Control operational, and does not believe that it would make sense to limit the review to only the costs that were forecast on September 6th.

[5] See Order No. 12-437, pp. 32
[6] The Company has reserved all of its rights to seek to recover any costs above this amount through subsequent PGAs or rate cases.



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## IV. APPLICATION OF INSURANCE PROCEEDS

**Q. How does NW Natural propose that insurance proceeds or other third-party recoveries be applied to the capital costs associated with the Gasco Source Control?**

A. As described above, NW Natural and the parties agreed to work collaboratively to determine an appropriate allocation of future insurance proceeds to the capital costs of the Gasco Source Control. NW Natural will look forward to discussions with the parties on this topic. Given that we are asking for prudence review and cost recovery of those costs at this time, we felt it appropriate to propose an allocation of insurance proceeds, as was agreed to in the Stipulation. NW Natural proposes that 10% of all insurance or other third-party recoveries received in 2013, be used to offset the Gasco Source Control capital costs included in rate base once such insurance receipts are reviewed by the Commission in the annual SRRM process, through a future adjustment to rates. The Company is of course willing to consider other alternatives and, as mentioned above, looks forward to working with the parties.

**Q. Does this conclude your testimony?**

A. Yes.



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BEFORE THE

PUBLIC UTILITY COMMISSION OF OREGON

**UG 263**

**NW Natural**

**Direct Testimony of Robert Wyatt**

**RECOVERY OF GASCO SOURCE CONTROL SYSTEM COSTS**

**EXHIBIT 200**

October 2013

# EXHIBIT 200–TESTIMONY OF ROBERT WYATT – GASCO SOURCE CONTROL SYSTEM

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Rates & Regulatory Affairs
**NW NATURAL**
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## I. INTRODUCTION AND SUMMARY

**Q. Please state your name and position with NW Natural Gas Company ("NW Natural" or "the Company").**

A. My name is Robert J. Wyatt. I am Environmental Manager of NW Natural. I manage all aspects of environmental remediation and compliance at NW Natural's former manufactured gas plant (MGP) sites.

**Q. Please describe your educational and professional background.**

A. I earned a Bachelor of Science degree in Geology in 1984 from Lafayette College in Easton, Pennsylvania. I studied hydrogeology at Temple University in Philadelphia, Pennsylvania from 1984 to 1986 and conducted additional graduate studies on coastal habitats at East Carolina University in North Carolina. I am a Licensed and Registered Geologist in Oregon, North Carolina, and Pennsylvania, and have also been a Licensed and Registered Geologist in Tennessee, Kentucky, and Georgia. In the mid-1980s, I began working as an environmental consultant focused primarily on Superfund and Resource Conservation and Recovery Act (RCRA) sites. I became Vice President of Front Royal Environmental Services, Inc. in 1989 and served as Senior Scientist and Principal in Charge for a number of large-scale projects. I became Environmental Manager of NW Natural in 2000.

**Q. Please summarize your testimony?**

A. In my testimony, I:

- Provide a description of the reasons for which NW Natural has constructed a hydraulic control and containment system, including a water treatment plant, on its Gasco site ("Gasco Source Control");



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- Describe DEQ's oversight of the design and construction of the Gasco Source Control system; and
- Describe the associated costs.

## II. BACKGROUND

**Q. For what purpose are you providing this testimony?**

A. I understand that in a stipulation the Company and several parties recently filed in Docket No. UM 1635, it was agreed that the capital costs associated with the Gasco Source Control system (referred to in the stipulation as the Gasco Pumping Station) would be evaluated for prudence after the system was placed in service, expected by the end of the third quarter of 2013, and that those costs would be included in rates at the same time as the first subsequent Purchased Gas Adjustment. My testimony is offered to confirm that the Gasco Source Control system has been placed in service, to provide a description of the requirements under which the Source Control system was constructed, and to set forth the costs of the project. This information is being provided so that the relevant parties, Commission Staff, and Commissioners can conduct the prudence review that was called for in the parties' stipulation in UM 1635 and in the Administrative Law Judge's Ruling dated October 8, 2013 issued in that same docket.

**Q. Have you provided testimony on this topic before?**

A. Yes. I provided testimony in NW Natural's general rate case, UG 221, regarding the general framework that governs NW Natural's environmental mitigation obligations at the Gasco and other sites. *See* NWN/Wyatt 1300, UG 221. That testimony provides relevant background, which I will not repeat here. In that testimony, I also described generally the Gasco Source Control project.



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## III. PURPOSE OF THE GASCO SOURCE CONTROL SYSTEM

**Q. Please generally describe the Gasco Source Control system.**

A. In general, the system serves to prevent groundwater contaminants from reaching the Willamette River. The Oregon Department of Environmental Quality (DEQ) selected hydraulic control and containment (HC&C) as the method for groundwater source control at the Gasco site and part of the adjacent Siltronic site. The Gasco Source Control system implements that selected method.

The Gasco Source Control system achieves hydraulic control and containment by the installation and operation of a series of groundwater recovery wells along the shoreline. Water from the wells is pumped via pipelines to a treatment plant. The treatment plant removes groundwater contaminants to levels at or below those specified by the site-specific National Pollution Discharge Elimination System (NPDES) permit. The hydraulic controls are monitored using observation points and recovery wells. There are currently a total of 21 recovery wells and 107 observation points in the system.

The Gasco Source Control system is one component of the remediation of the Gasco uplands. DEQ has the role of managing source control for the Portland Harbor Superfund Site, and has prioritized source control requirements in the Portland Harbor based on an agency ranking system. Due to the high priority ranking DEQ gave to the Gasco site, the design and construction of the Gasco Source Control system has been implemented under agency direction in advance of a comprehensive upland cleanup. The upland cleanup is described in more detail in my prior testimony (NWN/Wyatt 1300, UG 221).



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The Gasco Source Control system, including the recovery wells, pumps, controls, piping, and treatment plant are all now operational.

## IV. REQUIREMENT TO CONSTRUCT GASCO SOURCE CONTROL

**Q. Please describe why and how NW Natural was required to construct the Gasco Source Control system.**

A. Oregon's Environmental Cleanup Law authorizes DEQ to require the owner or operator of any facility from which a release of a hazardous substance has occurred to perform or pay for cleanup of property contaminated by the release. In 1993, DEQ proposed that the Gasco Site be added to the Oregon Confirmed Release List (the "CRL"). The CRL is the state law equivalent of EPA's Superfund list and DEQ may require owners and operators of listed sites to clean them up. Accordingly, in 1994, NW Natural entered DEQ's voluntary cleanup program for the Gasco Site by signing a Voluntary Agreement with DEQ. The Voluntary Agreement requires NW Natural to investigate contamination from the former Gasco manufactured gas plant (MGP) at both the Gasco Site and the adjacent Siltronic Site and, where necessary, to perform cleanup work or take measures to prevent contamination from spreading.

It is important to note that a Voluntary Agreement in this context is "voluntary" in a very limited sense. This fact can best be understood by reference to the 1993 letter, attached as Exhibit 201, in which DEQ requested that the Company enter into the Voluntary Agreement. As that letter makes clear, DEQ had identified the Gasco site as a high priority for action, and NW Natural could either participate in the voluntary program or DEQ would take immediate enforcement action. In either case, NW Natural would be required to pay the remediation costs. Importantly, however, by entering into



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the Voluntary Agreement the Company would have access to informal dispute resolution procedures; under the alternative enforcement action path the Company would not have even this degree of control over the process. In 2006, DEQ required an amendment to the Voluntary Agreement that added stipulated penalties and other provisions typical of consent orders.

In 2000, DEQ issued an Order Requiring Remedial Investigation and Source Control Measures at the Siltronic Site, attached as Exhibit 202, NW Natural and Siltronic are both subject to the Order, and NW Natural's work on the Gasco Source Control system is being performed pursuant to the Order as well as pursuant to the Voluntary Agreement. Under the Order, DEQ requested that NW Natural use information specific to groundwater and Dense Non Aqueous Liquid (DNAPL) contamination from the Gasco Uplands Remedial Investigation and Risk Assessment to prepare a Focused Feasibility Study (FFS) for groundwater and DNAPL source control.

NW Natural submitted the FFS in November of 2007. DEQ then issued a series of regulatory requirements and decisions related to the source control actions for the Gasco Site and the Siltronic Site, leading up to the final design and construction of the Gasco Source Control system. NW Natural has designed and constructed the system according to DEQ's directions.

**Q. Can you please describe the oversight that DEQ has exercised over the construction of the Gasco Source Control system?**

A. DEQ has provided detailed oversight over all aspects of the system design and construction. This oversight includes weekly and often daily DEQ interaction with design and construction team members, and DEQ-required design modifications for both major



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and very minor system components. In addition to approving design elements, DEQ provided ongoing, substantive and frequent direction on construction methods and materials after the design was approved.

DEQ's minute oversight can be understood through a review of the correspondence between NW Natural and the agency following the initial FFS. As I mentioned above, NW Natural provided its FFS to DEQ in November of 2007. That document evaluated potential methods for preventing contaminants from entering the river and groundwater, and, based on that evaluation, recommended a source control system design for review and approval by DEQ. Over the ensuing five years, DEQ provided NW Natural with its feedback on the initial FFS and several subsequent Source Control system design documents, shaping them into the final Groundwater Source Control Construction Design Report that DEQ eventually approved in August 2012.

The five-year review and approval process consisted of weekly and sometimes daily emails and telephone calls from DEQ that were periodically summed up in letters from DEQ evaluating each draft of the Source Control Plan line by line, and instructing the Company to make changes. These changes ranged from instructions to further study various details of the site's geology, to directions about which source control technology to select and construct. The full record of the correspondence is too voluminous to include in this testimony, but the following letters and reports provide an illustration of the degree to which DEQ managed every detail of the design and construction of the project.

- After NW Natural submitted the initial FFS in 2007, DEQ communicated with NW Natural via regular emails, meetings and teleconferences for four months,



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eventually summarizing its directions regarding the initial FFS in a letter dated March 21, 2008, attached as Exhibit 203. DEQ provided 10 pages of detailed comments requiring changes to the Company's source control analysis and design. Among other instructions, DEQ selected hydraulic control and containment as a primary source control action and instructed NW Natural to add additional extraction wells to the plan.

- NW Natural incorporated DEQ's directions into the Preliminary Design Report, in June 2008. The Preliminary Design Report developed the design and construction details for the source control actions selected by DEQ. After another period of regular email, telephone and in-person communications, DEQ summarized its directions regarding the Preliminary Design Report in a letter dated August 22, 2008, attached as Exhibit 204. DEQ instructed NW Natural to make numerous changes to the Preliminary Design Report, including the presumption that installation of a source control measure consisting of a vertical barrier wall and a hydraulic control and containment system would not limit DEQ's options for requiring additional cleanup work on the riverbank, even if the riverbank cleanup required reconstruction or relocation of extraction wells or the barrier wall.
- From August 2008 through November 2009, NW Natural continued to communicate with DEQ weekly as it worked on incorporating DEQ's 2008 directions into an Interim Design Report. After several more months of weekly emails, meetings and phone calls, DEQ summarized its comments on the Interim Design Report in a letter dated March 26, 2010, attached as Exhibit 205. In that



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letter, DEQ provided 16 pages of line-by- line instructions to NW Natural, including directing NW Natural to either install a vertical barrier wall across most of the Gasco and Siltronic shorelines or to construct and operate the hydraulic control and containment system only at the least contaminated areas of the Gasco site. NW Natural disputed this decision as described below.

- This cycle of reports, critiques, directions and revisions continued until DEQ conditionally approved the source control system design, conditionally allowing NW Natural to proceed with construction, in an August 9, 2012 letter, attached as Exhibit 206.

In addition to these communications with NW Natural, DEQ also at times interfaced directly with NW Natural's subcontractors and vendors. DEQ has reviewed every detail of the Source Control Plan at every step and has required substantial additions and modifications throughout the design and construction period.

**Q. You mentioned that participating in DEQ's voluntary program allowed the Company access to alternative dispute resolution procedures. Has the Company availed itself of those procedures?**

A. Yes. On March 26, 2010, DEQ directed NW Natural either to construct a vertical barrier wall in addition to NW Natural's proposal for extraction wells and a treatment system or to indefinitely delay any control of groundwater discharging to the river from the most heavily impacted area of the Gasco site (while still proceeding with extraction wells and the treatment system for less contaminated areas). NW Natural disputed this direction for more than two years, and eventually received DEQ approval, in August 2012, to proceed with construction of the hydraulic control and containment system. By disputing



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DEQ's initial direction, the Company avoided a potential cost increase of between $750,000 and $3.6 million, depending on final remediation directions.

## V. STATUS OF CONSTRUCTION OF THE SOURCE CONTROL SYSTEM

**Q. What is the status of the construction of the Gasco Source Control system?**

A. The Source Control system is operational and the system is in service, in accordance with the DEQ approved construction schedule.

## VI. COSTS OF CONSTRUCTION

**Q. Can you please describe the capital costs associated with the construction of the Gasco Source Control?**

A. NW Natural estimated in its September 6th testimony (filed in UM 1635) that the final total capital cost to place the source control system in service would be $19,048,300, which is the amount I understand is proposed to be recovered in NW Natural's tariff filing. I understand that we have incurred a cost at or above that amount as of the end of September. We continue to receive final invoices and therefore do not have the precise final number as of this date.

**Q. Can you describe the efforts that NW Natural has undertaken to ensure that the costs incurred to construct the Gasco Source Control are as low as reasonably possible?**

A. To ensure project costs are as low as reasonably possible we have implemented a number of controls. These include:

- Negotiating the selection of a cost-effective source control system for Gasco, including, as I mentioned, successfully disputing DEQ direction to construct a



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design that was technically flawed and that would have cost significantly more. That dispute was resolved when DEQ withdrew that direction.

- A bid process for key project construction elements implemented by our contractors and consultants but overseen and confirmed by the NW Natural Purchasing Department.
- Review and evaluation of all agency requirements to modify or supplement the design and to negotiate alternative outcomes with more cost-effective resolutions.
- A contract management review of all construction contractor payment applications to verify labor, equipment and material charges are appropriate and consistent with the terms of the contract.

## VII. CONCLUSION

**Q. Does this conclude your direct testimony?**

A. Yes, it does.



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NWN/201
Witness: Robert Wyatt

# BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

## UG 263

## NW NATURAL

**Exhibit Accompanying Direct Testimony of Robert Wyatt**

**Letter Dated September 10, 1993, from DEQ**

**October 2013**

Oregc

DEPARTMENT
ENVIRONMENT
QUALITY

September 10, 1993

CERTIFIED MAIL NO. P-915-447-128
RETURN RECEIPT REQUESTED

Ms. Sandra Hart
Northwest Natural Gas Co.
220 NW 2nd Ave.
Portland, OR 97209

Re: Northwest Natural Gas Co.
ECSI ID # 84

Dear Ms. Hart:

The Oregon Department of Environmental Quality (DEQ) has completed a Preliminary Assessment Equivalent (PAE) for the Northwest Natural Gas Co. site. In completing the PAE, the DEQ reviewed its file information on the site, including a 1987 federal Preliminary Assessment (PA). A Strategy Recommendation is included.

As noted in the Strategy Recommendation, the DEQ has determined that further action is required at this site to address releases of hazardous substances that threaten public health or the environment. Specifically, further sampling needs to be performed to characterize the extent of soil and groundwater contamination caused by the past disposal of coal tars by the Portland Gas & Coke Company. As described in the Strategy Recommendation, DEQ anticipates that the investigation will involve sampling on portions of the site currently leased to Pacific Northern Oil Co. and Koppers Industries, and on adjacent property owned by Wacker Siltronic Corporation.

The DEQ looks to parties responsible under Oregon's Environmental Cleanup Law to undertake necessary action beyond the PAE. In general, persons who have owned or operated a site during the time releases of hazardous substances have occurred and persons who knew or should have known of the release when they purchased the property are strictly liable for investigation and cleanup costs. Persons who have caused or contributed to the release are similarly liable. Oregon's Environmental Cleanup Law, ORS 465.255, describes the liability provisions more specifically, including defenses allowed. If the DEQ conducts further investigation or remedial action, it may recover its remedial action costs against responsible parties. The DEQ may also require liable parties to undertake remedial action necessary to protect public health and the environment under ORS 465.260.

Persons potentially responsible for investigation and cleanup of a site have the following options for pursuing further action. They may:

- Request the DEQ to oversee further investigation or cleanup through its Voluntary Cleanup Program; or

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Portland, OR 97204-1
(503) 229-5696
TDD (503) 229-6993
DEQ-1

- Wait until the DEQ notifies them of its intent to pursue further action at the site, determine responsibility at that time, and pursue the action required; or

- Pursue further action independently of the DEQ. The DEQ will review independent work in accordance with its priorities and may require additional action at the site. DEQ will track its cost in reviewing any site information and will seek to recover those costs against persons liable under ORS 465.255 if it determines that removal or remedial action is needed or was needed at the time DEQ made its recommendation for further action.

The DEQ strongly encourages persons to pursue action through the Voluntary Cleanup Program. Under any of these options, the DEQ will either require an agreement to pay its oversight costs as work proceeds or will track its costs and seek to recover them against responsible parties at a later date. The DEQ has determined that this site is a priority for further action, and unless we hear from you in the requested time period, we will contact you to proceed under the first or second of the listed options.

The status of this site will be updated in our Environmental Cleanup Site Information (ECSI) database and the site recommended for listing on the DEQ's Confirmed Release List and Inventory of hazardous substances sites list pursuant to ORS 465.215 and 465.225 and OAR 340-122-430 and 440. A letter regarding listing will follow.

We appreciate your cooperation in addressing this site. Please let us know within 30 days of receipt of this letter whether you plan to proceed with further action at this site. I can be reached at (503) 229-5657. To discuss the Voluntary Cleanup Program, please contact Karla Urbanowicz, at (503) 229-6729.

Sincerely,

Heather Schijf, Coordinator
Site Assessment Section
Environmental Cleanup Division

KD:m
SA\SM5385
Enclosure: Strategy Recommendation
cc: John Oxford, Koppers Co., Inc.
Bob Saling, Pacific Northern Oil Co.
Rudolf Staudigl, Wacker Siltronic Corp.
Dick Bach, Stoel, Rives, Boley, etc.
Mary Wahl, ECD, DEQ
Mike Rosen, VCS, DEQ
Thomas Miller, SRS, DEQ
SAS file #84

NWN/202
Witness: Robert Wyatt

# BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

## UG 263

## NW NATURAL

**Exhibit Accompanying Direct Testimony of Robert Wyatt**

**Order Requiring Remedial Investigation and Source Control Measures at the Siltronic Site**

**October 2013**

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY

| | |
|---|---|
| In the Matter of<br><br>WACKER PROPERTY<br><br>WACKER SILTRONIC CORPORATION and NORTHWEST NATURAL GAS COMPANY,<br><br>Respondents | DEQ No. ECVC-NWR-00-27<br><br>ORDER REQUIRING REMEDIAL INVESTIGATION AND SOURCE CONTROL MEASURES |

Pursuant to ORS 465.260(4), the Director, Oregon Department of Environmental Quality (DEQ), issues this Order to Wacker Siltronic Corporation and Northwest Natural Gas Company (Respondents).

1. Purpose

The purpose of this Order is to determine the nature and extent of releases of hazardous substances to Willamette River sediments from certain property in Multnomah County, and to develop and implement source control measures to address such releases, if necessary.

2. Findings of Fact

A. Respondent Wacker Siltronic Corporation (Wacker) is a Delaware corporation registered to do business in Oregon. Respondent Northwest Natural Gas Company (NW Natural) is an Oregon corporation.

B. Wacker owns real property located at 7200 NW Front Avenue in Portland (Wacker Property), occupying approximately 85 acres along the Willamette River. The Wacker Property was once owned by the Portland Gas and Coke Company (GASCO), which operated an oil gasification plant at the Wacker Property and adjacent properties from 1913 to 1956. Wacker acquired the property in 1978. From March 1980 to present, Wacker has operated a silicon wafer fabricating plant at the property. The general location of the Wacker Property is shown on Attachment A to this Order.

C. NW Natural owns real property adjacent to the Wacker Property, at 7900 NW St. Helens Road in Portland (NW Natural Property). The NW Natural Property was owned as one parcel with the Wacker Property and operated as an oil gasification plant by GASCO. In 1958, GASCO became Northwest Natural Gas Company. NW Natural sold the portion of the GASCO property now owned by Wacker in 1962. The general location of the NW Natural Property is shown on Attachment A to this Order.

D. The former GASCO plant produced oil gas and lampblack briquettes. Waste generated at the plant included tar, spent oxide, and wastewater containing dissolved and suspended hydrocarbons. Before 1941, wastewater was discharged directly to the Willamette River. In 1941, a series of settling or tar ponds were constructed to receive wastewater. These ponds were located on what is now the NW Natural Property and extended on to the northern portion of the Wacker Property, in areas of low elevation prone to flooding. The tar ponds were periodically excavated and the dredged tar disposed in low-lying areas, including on what is now the Wacker Property. The exact nature and location of these disposal areas are unknown. Over time, the tar ponds were filled with spent oxide material, soil, and rubble and the consolidated materials spread over the southeastern portion of the NW Natural Property and portions of the Wacker Property.

E. Subsurface petroleum or tar has been encountered before and during various construction activities on the Wacker Property after Wacker's acquisition of the property.

F. In July and August 1985, groundwater samples collected at the Wacker Property were found to contain benzene, polycyclic aromatic hydrocarbons (PAHs), cyanide, and lead at concentrations above federal drinking water maximum contaminant levels. In July 1990, two soil samples collected from geotechnical borings at the Wacker Property were found to be saturated with a black, oily viscous substance. Total PAH concentrations detected in the two samples were 10,000 milligrams per kilogram (mg/kg) and 6,100 mg/kg, respectively. In October

1990, groundwater samples collected along the utility corridor at the Wacker Property were found to contain benzene and total petroleum hydrocarbons in concentrations up to 23.3 milligrams per liter (mg/l) and 89.1 mg/l, respectively. In October 1997, Willamette River sediment samples collected adjacent to the Wacker Property were found to contain concentrations of PAHs up to 100 times baseline concentrations established for the Portland Harbor area. In July 1998, an oil sheen was observed on the Willamette River. The oil sheen originated from contaminated sediments encountered during riverbank repair activities at the Wacker Property. Total petroleum hydrocarbon analysis of the contaminated material detected up to 69 mg/kg gasoline, 5810 mg/kg diesel, and 2970 mg/kg heavy oil.

G. The Wacker Property is located within a six-mile reach of the Willamette River between Sauvie Island and Swan Island known as the Portland Harbor. A 1997 study by the U.S. Environmental Protection Agency (EPA) identified elevated levels of hazardous substances in shallow, near-shore sediments throughout the Portland Harbor. EPA has proposed the Portland Harbor for inclusion on the National Priorities List (NPL). The Portland Harbor sediments will be the subject of a remedial investigation and feasibility study conducted outside this Order under EPA and/or DEQ oversight. Hazardous substances releases at the NW Natural Property and to Willamette River sediments from the NW Natural Property are the subject of DEQ Agreement No. WMCVC-NWR-94-13, entered August 8, 1994. This Order addresses sources, pathways, and source control measures for hazardous substance releases at the Wacker Property and to sediments adjacent to the Wacker Property.

H. Each Respondent has refused one or more requests by DEQ that remedial investigation and source control measures be performed at the Wacker Property under consensual arrangement with DEQ.

3. Conclusions of Law and Determinations

Based on the above Findings of Fact and the administrative record, DEQ determines that:

A. The substances described in Subsection 2.F. are "hazardous substances" within the meaning of ORS 465.200(15).

B. The presence of hazardous substances in soils, groundwater, and sediments at or near the Wacker Property is the result of a "release" into the environment within the meaning of ORS 465.200(21).

C. The Wacker Property and adjacent contaminated sediments are a "facility" within the meaning of ORS 465.200(12).

D. Wacker and NW Natural each is a "person" within the meaning of ORS 465.200(20).

E. As current or past owner or operator of a facility, each Respondent is strictly and jointly and severally liable under ORS 465.255, and therefore may be required by DEQ to conduct any removal or remedial action necessary to protect public health, safety, and welfare and the environment, pursuant to ORS 465.260 (4).

F. The activities required by this Order are necessary to protect public health, safety, and welfare and the environment.

Based on the above Findings of Fact and Conclusions of Law and Determinations,

DEQ ORDERS:

4. Notice of Intent to Comply

No later than 10 calendar days after issuance of this Order, Respondents, jointly or individually, shall provide written notice to DEQ of Respondents' intent to comply with this Order.

5. Work to be Performed

A. Remedial Investigation

Respondents shall perform a Remedial Investigation (RI) in accordance with OAR Chapter 340 Division 122, the terms and schedules set forth in the Scope of Work (SOW) contained in Attachment B to this Order, and the terms and schedules set forth in any DEQ-approved work plan. Once approved by DEQ, a work plan shall be deemed to be incorporated into and made a fully enforceable part of this Order.

B. Source Control Measures

In accordance with the SOW, Respondents shall identify, characterize, and evaluate any unpermitted discharge or migration of contaminants to the Willamette River or sediments identified in the RI, and, as necessary, develop and implement source control measures to address such releases.

C. Additional Measures

(1) Respondents may elect at any time during the term of this Order to undertake measures, beyond those required under this Order and the SOW, necessary to address the release or threatened release of hazardous substances at the Wacker Property. Such additional measures (including but not limited to engineering or institutional controls and other removal or remedial measures) shall be subject to prior approval by DEQ;

(2) DEQ may determine that, in addition to work specified in the SOW or an approved work plan, additional work is necessary to complete the RI in satisfaction of the SOW and OAR Chapter 340 Division 122, or is necessary to address unanticipated threats to human

health or the environment. DEQ may require that such additional work be incorporated into the applicable work plan by modification and/or performed in accordance with a DEQ-specified schedule. Respondents shall modify the work plan and/or implement the additional work in accordance with DEQ's directions and schedule.

D. Dredging Activities

Respondents shall notify the DEQ Project Manager at least 60 days before undertaking any dredging or other activity that might disturb sediments at or near the Wacker Property. In the notice of dredging or other activity, Respondents shall: (1) evaluate the concentration of hazardous substances present in and below the affected sediments, based on sampling and analyses performed in advance of the notice; (2) document the steps to be taken to ensure that both the activity and the subsequent management and disposal of dredged spoils will be conducted in a manner protective of human health and the environment; and (3) evaluate the effect of the activity on the Portland Harbor remedial investigation and feasibility study. Dredging may proceed under existing permits subject to the above notice and the implementation of any additional dredging or management practices required by DEQ. Respondents shall also notify DEQ of and copy DEQ on any permit application to the Oregon Division of State Lands or United States Army Corps of Engineers for dredging or other activity disturbing sediments adjacent to the Wacker Property. Notwithstanding the foregoing, Respondents may conduct dredging or other activities that might disturb sediments at or near the Wacker Property without giving DEQ 60 days notice, if such activities are conducted in accordance with an effective dredging agreement between Respondents and DEQ describing the notification and sampling requirements, dredging, management, and disposal practices, and any other measures Respondents will take to ensure that all activities within the scope of the dredging agreement are conducted in a manner that is protective of human health and the environment and consistent with harborwide remedial work.

6. General Provisions

A. Qualifications of Personnel

(1) All work required by this Order shall be performed under the supervision of a qualified environmental professional experienced in hazardous substance investigation or remediation. Within 15 calendar days of issuance of this Order, Respondents shall provide DEQ, in writing, the name, title, and qualifications of such supervising personnel and of contractors and subcontractors to be used in performance of work. Qualifications of such personnel shall be subject to DEQ review and, at DEQ's election, DEQ written approval or disapproval. If DEQ disapproves, in writing, the qualifications of any personnel, Respondents shall provide DEQ, in writing, the name, title, and qualifications of replacement personnel, subject to DEQ's review and approval as described above, within 15 calendar days of DEQ's issuance of written disapproval. If DEQ subsequently disapproves the replacement personnel, DEQ reserves its right under ORS 465.260 to perform the work required under this Order and to seek reimbursement of its costs from Respondents.

(2) If Respondents change supervisory or key contractor personnel during the course of work under this Order, the qualifications of the new personnel shall be subject to DEQ review and approval in accordance with Paragraph (1) above.

(3) DEQ approval of the qualifications of an environmental professional selected by Respondents does not constitute DEQ endorsement of that professional or that professional's work product, and Respondents remain responsible for each professional's work and work product.

B. DEQ Approvals

(1) Respondents shall not proceed to implement any plan or activity required under this Order, and shall not proceed with any other investigative or remedial activity concerning hazardous substances released to the environment at or near the Wacker Property, until DEQ review and written approval of the activity is received. Any reports, plans,

specifications, schedules, or other deliverables required by the Order, upon approval by DEQ, are incorporated into this Order. Any noncompliance with such DEQ-approved deliverables shall be considered a violation of this Order.

(2) After review of any plan, report, or other item required to be submitted for DEQ approval under this Order, DEQ will:

(a) Approve the deliverable in whole or in part; or

(b) Disapprove the deliverable in whole or in part and notify Respondents of deficiencies and/or request modifications to cure the deficiencies.

(3) In the event of DEQ's disapproval or request for modification of a deliverable, Respondents shall correct the deficiencies and resubmit the revised report or other item for approval within 10 calendar days of receipt of the DEQ notice or within such other time specified in the notice.

(4) In the event of two deficient submittals of the same deliverable, DEQ may modify the submission to cure the deficiencies.

(5) In the event of approval or modification of a deliverable by DEQ, Respondents shall implement the actions(s) required by the plan, report, or other item as approved or modified by DEQ.

C. DEQ Access and Oversight

(1) Respondents shall allow DEQ to enter and move freely about all portions of their respective properties at all reasonable times for the purposes, among other things, of inspecting records relating to work under this Order, observing Respondents' progress in implementing this Order, conducting such tests and taking such samples as DEQ deems necessary under this Order, verifying data submitted to DEQ by Respondents, and using camera, sound recording, or other recording equipment.

(2) Respondents shall notify DEQ of any excavation, drilling, sampling, construction, and surveying to be conducted under this Order, as well as any other on-site activities for which DEQ requests advance notice, at least five calendar days before such

activity. Upon DEQ's verbal request, Respondents shall make available to DEQ a split or duplicate of any sample taken in connection with this Order.

D. Project Managers

(1) All reports, notices, and other communications required under or relating to this Order shall be directed to:

DEQ Project Manager
Eric Blischke
Oregon Department of Environmental Quality
Northwest Region
2020 SW Fourth Avenue, Suite 400
Portland, Oregon 97201
(503) 229-5648
(503) 229-6899 (fax)
blischke.eric@deq.state.or.us

(2) Within five calendar days of notification of intent to comply under Section 4 of this Order, Respondents shall provide DEQ with written designation of one Project Manager for purposes of this Order and receipt of notices and other communications. Respondents' designated Project Manager must be authorized to make day-to-day decisions necessary to accomplish the work required by this Order. Respondents shall notify DEQ of any change in their designated project manager, in writing, within 48 hours of the change.

E. Quality Assurance

Respondents shall conduct all sampling, sample transport, and sample analysis in accordance with the quality assurance/quality control (QA/QC) provisions approved by DEQ in the work plan required by the attached SOW. Respondents shall ensure that each laboratory used by Respondents for analysis performs such analysis in accordance with the approved QA/QC provisions. Respondents shall also ensure that DEQ and its authorized representatives are allowed access at reasonable times to laboratories and personnel used by Respondents for sample analysis.

F. Records

(1) In addition to those reports and documents specifically required under this Order, Respondents shall provide to DEQ, within 10 calendar days of DEQ's request, copies of QA/QC memoranda and audits, raw data, draft and final plans, draft and final reports, task memoranda, field notes, and laboratory analytical reports that relate in any way to activities under this Order or to other investigative or remedial activities concerning releases of hazardous substances at or from Respondents' respective properties

(2) Each Respondent shall preserve all records and documents in its possession or control or that of its employees, agents, or contractors relating in any way to activities conducted under this Order, for at least 10 years after termination of this Order pursuant to Section 7 below. Upon DEQ's request, Respondent shall provide copies of such records to DEQ.

G. Progress Reports

During each month of this Order, Respondents shall deliver to DEQ on or before the fifteenth day of each month two copies of a progress report containing:

(a) Actions taken under this Order during the previous month;

(b) Actions scheduled to be taken in the next two months;

(c) Sampling, test results, and any other data generated or received during the previous month; and

(d) A description of any problems experienced during the previous month and actions taken to resolve them.

H. Other Laws

Subject to ORS 465.315(3), all actions under this Order shall be performed in accordance with all applicable federal, state, and local laws and regulations.

I. NPL Listing

DEQ reserves its right to modify this Order, the SOW, or the scope of any deliverable required thereunder to address any additional obligations deemed necessary to protect public health, safety, and welfare or the environment if the Wacker Property or the Portland Harbor become part of a federal National Priority List site.

7. Satisfaction of Order

Upon completion of work under this Order, Respondents shall submit to DEQ a written notice of completion. This Order shall be deemed satisfied and terminated upon DEQ's issuance of a certification of satisfactory completion of activities required by this Order.

IT IS SO ORDERED:

By: _____ Date: 10/4/00

Langdon Marsh, Director
Oregon Department of
Environmental Quality

NOTICE REGARDING FAILURE TO COMPLY:

1. Upon Respondents' failure to comply with this Order, DEQ may seek any available remedy to enforce this Order, including but not limited to civil penalties and injunctive relief. ORS 465.260, 465.900.

2. Upon Respondents' failure to comply with this Order, Respondents may be liable for any costs incurred by the State of Oregon in conducting the work required under this Order and for punitive damages of up to three times the amount of the state's costs. ORS 465.260 (8)

3. Respondents may not seek an administrative appeal or judicial review of this Order. ORS 465.260(6).

NOTICE REGARDING DEQ COSTS:

Pursuant to ORS Chapter 465, the Respondents named in this Order are liable for costs incurred by DEQ in issuing and overseeing implementation of this Order. DEQ will issue the Respondents a monthly invoice of DEQ costs and request payment by check payable to the "State of Oregon, Hazardous Substance Remedial Fund." Any amounts not paid within 30 calendar days of issuance of the invoice will be subject to a nine-percent (9%) per annum interest charge. Any amounts that remain unpaid will be subject to recovery by DEQ pursuant to ORS 465.330 through 465.335 and other applicable law.

CERTIFICATE OF SERVICE BY MAIL

I certify that on Oct. 4, 2000, I served the foregoing ORDER by certified mail, postage prepaid, upon:

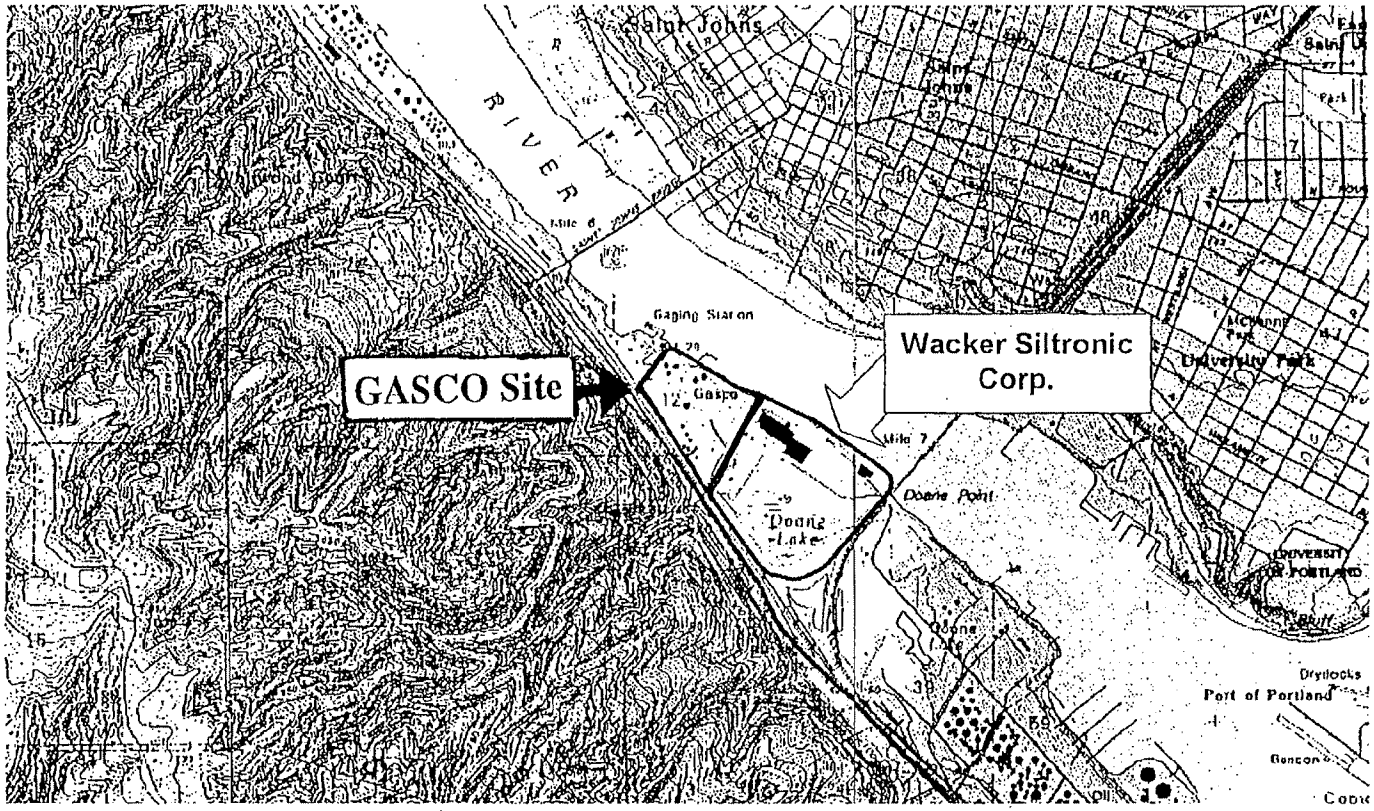
Richard Bach
of Attorneys for Northwest Natural Gas Co.
Stoel Rives LLP
900 SW Fifth Avenue
Suite 2600
Portland, Oregon 97204

Christopher Reive
of Attorneys for Wacker Siltronic Corp.
Tarlow Jordan & Schrader
Two Centerpointe Drive
Sixth Floor
Lake Oswego, OR 97035

Eric Blischke

# ATTACHMENT A

# SITE LOCATION MAP




Source: USGS, Linnton and Portland Quadrangles (1990)

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Approximate Scale: 1" = 2325'

**Figure 1**
Location Map
Wacker Siltronic Corp.

BRIDGEWATER GROUP, INC.

# ATTACHMENT B

## SCOPE OF WORK FOR
## REMEDIAL INVESTIGATION AND SOURCE CONTROL MEASURES

### I. SCHEDULE

Respondents shall submit for DEQ review and approval a Remedial Investigation (RI) work plan and subsequent plans and reports that address all elements of this Scope of Work (SOW). Elements of the SOW may be addressed by alternative means or by using existing data or information to the extent that the data are applicable, meet the objectives of the RI, and meet quality assurance and quality control (QA/QC) requirements.

All work required under this Order shall be performed in accordance with the schedule below:

| | |
|---|---|
| **RI Scoping Document** | An RI Scoping Document shall be submitted to DEQ within 45 days of issuance of this Order. |
| **DEQ Review and Comment** | To Respondents after receipt of RI Scoping Document |
| **Draft Phase I RI Work Plan** | To DEQ within 60 days of receipt of DEQ comments on RI Scoping Document. |
| **DEQ Review and Comment** | To Respondents after receipt of Draft Phase I RI Work Plan. |
| **Final Phase I RI Work Plan** | To DEQ within 30 days of receipt of DEQ comments on draft Phase I RI Work Plan. |
| **Initiation of Phase I RI** | Phase I site characterization activities to be completed within 4 months of DEQ approval of final Phase I RI Work Plan. |
| **Phase I Site Characterization Summary** | To DEQ within 90 days of completion of Phase I site characterization activities. |
| **DEQ Review and Comment** | To Respondents after receipt of Phase I Site Characterization Summary. |
| **Technical Memorandum on Source Control Measures** | To DEQ within 90 days of completion of Phase I site characterization activities. |
| **DEQ Review and Comment** | To Respondents after receipt of Technical Memorandum on Source Control Measures. |
| **Preliminary Design of Source Control Measures** | To DEQ within 60 days of DEQ determination that Source Control Measures are necessary. |
| **DEQ Review and Comment** | To Respondents after receipt of Preliminary Design of Source Control Measures. |

| | |
|---|---|
| **Final Design of Source Control Measures** | To DEQ within 30 days of receipt of DEQ comments on Preliminary Design of Source Control Measures. |
| **Initiation of Source Control Measures** | Source Control Measures to be constructed and initiated within 6 months of DEQ approval of Final Design of Source Control Measures. |
| **Draft Phase II RI Work Plan Supplement** | To DEQ within 60 days of DEQ determination that additional site characterization activities are necessary. |
| **DEQ Review and Comment** | To Respondents after receipt of Draft Phase II RI Work Plan Supplement. |
| **Final RI Phase II RI Work Plan Supplement** | To DEQ within 30 days of receipt of DEQ comments on Draft Phase II RI Work Plan Supplement. |
| **Initiation of Phase II RI** | To be completed within six months of DEQ approval of Phase II RI Work Plan Supplement. |
| **Draft RI Report** | To DEQ within six months of completion of all site characterization activities. |
| **DEQ Review and Comment** | To Respondents after receipt of Draft RI Report. |
| **Final RI Report** | To DEQ within 45 days of receipt of DEQ comments on Draft RI Report. |

Additional work plans and work plan amendments are subject to DEQ review and approval and shall be processed according to schedules established by DEQ at the time of each phase change or task addition. Respondents shall initiate and complete work according to the schedule specified in the applicable approved work plan or amendment.

## II. OBJECTIVES

Work performed under this Order shall complement and incorporate existing facility information with the following specific objectives:

A. All work performed under this order shall incorporate the results of, and be coordinated with, the remedial investigation, feasibility study and source control measures at the GASCO site.

B. Identify and characterize all past and present hazardous substance source areas at the Wacker facility. Source areas shall be characterized through a review of historical information and the collection of environmental samples for chemical, geotechnical, and other analyses. The evaluation of source areas shall focus on upland operations that may have resulted in a release of hazardous substances.

C. Evaluate all past and present contaminant migration pathways at the Wacker facility. Key elements relevant to contaminant migration include, but are not limited to, the rate and direction of groundwater flow, subsurface contaminant migration to the Willamette River, overland contaminant migration to the Willamette River, storm water discharge to the Willamette River, direct and indirect release to the Willamette River, preferential migration pathways, volatilization, dust entrainment, and riverbank seepage.

D. Determine the nature, extent, and distribution of hazardous substances in affected media at the Wacker facility. This analysis should focus on the vertical and horizontal extent of contamination, groundwater contamination, and surface and subsurface soil contamination.

E. Identify all current and reasonably likely future human and ecological receptors in the locality of the Wacker facility. Receptors shall include human and ecological receptors that may be exposed to hazardous substances in the locality of the facility. This analysis should consider all relevant contaminant migration pathways and the nature, extent and distribution of hazardous substances in affected media.

F. Collect sufficient data and historical information to allow the identification of possible areas of sediment contamination adjacent to the Wacker facility. Areas of potential sediment contamination will be characterized through a Portland Harbor sediment investigation conducted outside this Order. Data collection and evaluation under this Order shall consider the potential for contaminant migration to the Willamette River and over or in-water releases of hazardous substances resulting from current and historic operations at the Wacker facility. Respondents may be required to perform limited sediment or benthic sampling adjacent to the facility as necessary to address an objective of this Scope of Work.

G. Evaluate the risk to human health and the environment from releases of hazardous substances at or from the Wacker facility through the performance of human health and ecological risk assessments.

H. Identify hot spots of contamination, if any, at the Wacker facility.

I. Generate or use data of sufficient quality for site characterization and risk assessment at the Wacker facility.

J. Develop the information necessary to evaluate and design necessary source control measures to address contaminant releases to the Willamette River from the Wacker facility, in coordination with source control measures at the GASCO facility.

K. Implement necessary source control measures to address contaminant releases to the Willamette River from the Wacker facility, in conjunction with source control measures at the GASCO facility.

## III. MONTHLY REPORTS

Two (2) copies of a monthly report shall be submitted to DEQ by the 15th day of the month following the reporting period. The monthly reports shall summarize activities performed, data results collected or received, problems encountered or resolved during the previous month, and activities planned for the upcoming two months.

## IV. RI SCOPING DOCUMENT

Respondents shall prepare an RI Scoping Document. The RI Scoping Document shall include a comprehensive review of site history, previous and ongoing environmental investigations, physiographic features, biological resources and demographic characteristics. The comprehensive review shall consider both the Wacker facility and adjoining GASCO facility. The RI Scoping Document shall present a proposed approach for completing a remedial investigation based on a review of existing information. The proposed RI approach shall address soil, groundwater, surface water, sediments, and air. The proposed RI approach shall provide the framework for the RI Work Plan and shall include, at a minimum, a summary of data collected to date, a conceptual site model (including a conceptual site hydrogeologic model), and a description of RI goals and objectives. The RI Scoping Document shall demonstrate that the proposed RI approach is adequate to meet the schedule specified in this SOW. The RI proposal shall consider methodologies presented in the Portland Harbor Sediment Management Plan and the draft Portland Harbor Sediment Investigation Work Plan dated March 31, 2000.

## V. REMEDIAL INVESTIGATION WORK PLAN

A remedial investigation work plan shall be submitted according to the schedule specified in Section I above. The work plan shall be coordinated with, and incorporate any available results of, the RI/FS at the GASCO facility. The work plan shall be developed in accordance with applicable Oregon Administrative Rules (OAR 340-122-010 through -115), DEQ guidance, and the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, OSWER Directive 9355.3-01, 1988, as appropriate. Existing data may be used if it meets data quality objectives for the RI. The results of the RI will be used to guide data collection efforts performed as part of the Portland Harbor sediment investigation outside this Order. The submitted work plan shall include, but not be limited to, the following items:

### A. PROJECT MANAGEMENT PLAN

The RI work plan shall include a project management plan. The project management plan shall include a schedule for submittal of all documents and implementation of all proposed activities and phases pertaining to this Scope of Work consistent with the schedule specified in Section I; a description of the personnel (including subcontractors, if known) involved in the project, and

their respective roles in the project; and a discussion of how approved variations from the approved work plan will be managed.

**B. SITE DESCRIPTION**

The RI work plan shall include a discussion of the current understanding of the physical setting of the facility and surrounding area; the facility history; hazardous substance and waste management history; facility operations conducted on, in, over, or adjacent to the Willamette River, and current facility conditions.

**C. SITE CHARACTERIZATION PLAN**

The RI work plan shall include a site characterization plan. The site characterization plan shall be consistent with DEQ guidance and the requirements specified in OAR 340-122-080. The site characterization plan shall include, but not be limited to, characterization of the hazardous substances, characterization of the facility, identification of potential receptors, and the collection and evaluation of information relevant to the identification of hot spots of contamination, and shall address the following:

1. **Soils**

Objective: To identify and characterize releases of hazardous substances from the facility to soils.

Scope: The plan shall supplement previous soil sampling at the facility. The plan shall address all areas of the facility which could potentially have received spills, have received leaks from tanks or piping, have been used for waste treatment or disposal, or have been affected by contaminated surface water or storm water runoff, and all other areas of the facility where soil contamination is known or suspected.

Procedures: The plan shall be designed and conducted to determine the vertical and lateral extent of soil contamination, determine the extent to which soil contamination may contribute to Willamette River sediment contamination, characterize the facility geology, determine the physical and chemical soil characteristics relevant to the RI, evaluate the potential for contaminant migration, and gather the information necessary to identify hot spots of contamination. The plan shall include the proposed methodology for characterizing soil.

2. **Groundwater**

Objective: To identify and characterize releases of hazardous substances from the facility to groundwater.

Scope: The plan shall supplement previous investigations at the facility and shall identify and characterize all past, current, and potential releases of hazardous substances to groundwater from the facility.

Procedures: The plan shall be designed and conducted to determine: the vertical and lateral extent of groundwater contamination, both on-site and, if applicable, off-site; estimate the rate of contaminant flux to the Willamette River; determine the extent to which free phase product is migrating to the Willamette River; characterize the facility hydrogeology; determine the physical and chemical characteristics of each water bearing zone relevant to the RI; evaluate the potential for contaminant migration through groundwater; and gather the information necessary to identify hot spots of contamination. The plan shall include the proposed methodology for characterizing groundwater. Alternative methods for characterizing groundwater should be considered to accelerate the RI. Monitoring wells and other holes must be drilled, constructed, and decommissioned in accordance with OAR Chapter 690, Division 240 and DEQ "Ground Water Monitoring Well, Drilling, Construction and Decommissioning" guidelines (DEQ 1992).

3. **Surface Water**

Objective: To identify and characterize releases of hazardous substances from the facility to surface water.

Scope: The plan shall supplement previous investigations at the facility and shall identify and characterize all past, current, and potential impacts to surface waters from the facility.

Procedures: The plan shall be designed to: determine the extent to which surface water may have been impacted by releases of hazardous substances at the facility; determine the nature and extent of surface water contamination; characterize the facility hydrology; determine the physical and chemical surface water characteristics relevant to the RI including flow characteristics; evaluate the potential for contaminant migration and gather the information necessary to identify hot spots of contamination. The plan shall include the proposed methodologies for characterizing surface water.

4. **Sediments**

Objective: To identify and characterize releases of hazardous substances from the facility to sediments.

Scope: The plan shall supplement previous investigations at the facility, and shall identify and characterize all past, current, and potential releases of hazardous substances to sediments from the facility in a manner consistent with the Portland Harbor sediment investigation conducted outside this Order.

Characterization of the nature and extent of sediment contamination is not required under this Order, but is contemplated to be completed through a Portland Harbor sediment investigation.

Procedures: The plan shall be designed to identify sources of sediment contamination from the facility, and characterize release mechanisms from the facility to sediments. The plan shall include the proposed methodology for characterizing releases to sediments and as applicable shall utilize methodologies presented in the Portland Harbor Sediment Management Plan and the draft Portland Harbor Sediment Remedial Investigation and Feasibility Study Work Plan dated March 31, 2000.

5. **Air**

Objective: To identify and characterize any release of hazardous substances to the air, from soil, surface water, or groundwater contamination at the facility.

Scope: The plan shall supplement previous investigations at the facility and shall identify and characterize all past, current, and potential releases (e.g. contaminated soil or groundwater) of hazardous substances to air.

Procedures: The plan shall include the proposed methodologies for evaluating air emissions using appropriate emission calculations and/or a field sampling program. The plan shall be designed to delineate the nature and extent of contamination, characterize the site climatology, determine the physical and chemical air characteristics relevant to the RI, evaluate the potential for contaminant migration to the Willamette River and surrounding areas, and gather the information necessary to identify hot spots of contamination.

6. **Identification of Current and Reasonably Likely Future Land and Water Use**

Objective: To identify current and reasonably likely future land and water uses in the locality of the facility, excluding those of the Willamette River.

Scope: The plan shall be designed to identify current and reasonably likely future land and water uses for the purposes of identifying hot spots of contamination and conducting the baseline human health and ecological risk assessments based on OAR 340-122-080, DEQ Guidance, and the Portland Harbor Sediment Management Plan.

Procedures: The plan shall include the proposed methodology for identifying current and reasonably likely future land and water uses in the locality of the facility (excluding uses of the Willamette River).

**D. SAMPLING AND ANALYSIS PLAN (SAP)**

Objective: To adequately document all sampling and analysis procedures.

Scope: In preparation of the SAP, the following guidance documents shall be utilized: Data Quality Objectives for Remedial Response Activities, EPA/540/G-87/004 (OSWER Directive 9355.0-7B), March, 1987; Test Methods for Evaluating Solid Waste, SW-846 and appropriate updates; and A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001 (OSWER Directive 9355.0-14), December, 1987. The SAP shall address all topics listed in Environmental Cleanup Division Policy #760.000, Quality Assurance Policy.

Procedures: The work plan shall include a (SAP). The SAP shall include (QA/QC) procedures for both field and lab procedures. The SAP shall be sufficiently detailed to function as a manual for field staff.

**E. HEALTH AND SAFETY PLAN (HASP)**

Objective: To establish policies and procedures to protect workers and the public from the potential hazards posed by a hazardous materials site.

Scope: The HASP portion of the work plan shall comply with 29 CFR 1910.120 and OAR Chapter 437, Division 2.

Procedures: The HASP shall include a description of risks related to RI activities, protective clothing and equipment, training, monitoring procedures, decontamination procedures, and emergency response actions.

**F. MAPS**

The work plan shall include a scaled map or maps of the facility, which clearly shows facility topography, on-site structures, subsurface utility lines, waste storage and disposal areas, location of sensitive environments, and proposed sampling locations.

**G. WORK PLAN FOR EVALUATION AND IMPLEMENTATION OF SOURCE CONTROL MEASURES**

Objective: To evaluate, design and implement necessary source control measures to address contaminant migration to the Willamette River from the Wacker facility, in coordination with source control measures at the GASCO facility.

Scope: The plan shall gather sufficient information to evaluate, design, and implement necessary source control measures from the

Wacker facility, in coordination with source control measures at the GASCO facility.

Procedures: The plan shall be designed and conducted to characterize all release mechanisms to the Willamette River from the Wacker facility, in coordination with source control measures at the GASCO facility. Characterization data shall be adequate to evaluate, design, and implement necessary source control measures. Source control measures shall address contaminant migration to the river through overland transport, storm water runoff, free phase product migration, direct release, and/or dissolved groundwater contaminant migration.

## H. RISK ASSESSMENT WORK PLAN

### 1. Upland Human Health Risk Assessment

Objective: To evaluate the collective demographic, geographic, physical, chemical, and biological factors at the facility, for the purposes of: characterizing current or reasonably likely future risks to human health as a result of a threatened or actual release(s) of a hazardous substance at or from the facility; documenting the magnitude of the potential risk at the facility; supporting risk management decisions; and establishing remedial action goals if necessary.

Scope: The human health risk assessment shall evaluate risk in the context of current and reasonably likely future land and water uses and in the absence of any actions to control or mitigate these risks (i.e., under an assumption of no action). The human health risk assessment portion of the work plan shall be developed based on the requirements specified in OAR 340-122-084, DEQ guidance, and the Risk Assessment Guidance for Superfund – Human Health Evaluation Manual Part A, United States Environmental Protection Agency (EPA) Interim Final, July 1989 (RAGS-HHEM). The work plan shall use Exhibit 9-1 of the RAGS-HHEM as a framework for discussing the methodologies and assumptions to be used in assessing the potential human health risks at the facility.

Procedure: The plan shall describe the different tasks involved in preparing the human health risk assessment. The human health risk assessment can be completed using either deterministic or probabilistic methodologies. If probabilistic methodologies are to be used, then Respondents shall obtain DEQ approval of the proposed risk protocol before the commencement of a probabilistic risk assessment.

The upland human health risk assessment shall be designed to achieve the following:

a. Develop appropriate exposure units considering the nature, extent, and distribution of contamination and the reasonably

likely future land and water use in the locality of the facility;

b. Establish data quality objectives for each exposure unit identified;
c. Collect data appropriate to satisfy the data quality objectives for each exposure unit;
d. Identify contaminants of interest for each media of concern;
e. Develop exposure scenarios based on current and reasonably likely land use, facility features, and populations potentially exposed;
f. Identify appropriate exposure factors for all exposure pathways to be evaluated;
g. Identify the appropriate toxicity factors for all exposure pathways to be evaluated; and
h. Quantify the risks to human health at the facility.

2. **Upland Ecological Risk Assessment**

Objective: To evaluate the collective demographic, geographic, physical, chemical, and biological factors at the facility, for the purposes of: characterizing current or reasonably likely future risks to the environment as a result of a threatened or actual release(s) of a hazardous substance at or from the facility; quantifying the potential risk at a facility; supporting risk management decisions; and establishing remedial action goals if necessary.

Scope: The ecological risk assessment shall evaluate risk in the context of current and reasonably likely future land and water uses and in the absence of any actions to control or mitigate these risks (i.e., under an assumption of no action). The ecological risk assessment shall use a tiered approach (with four levels) to produce a focused and cost-effective assessment of risk. The ecological risk assessment work plan shall be developed based on the requirements specified in OAR 340-122-084 and DEQ guidance.

Procedure: The plan shall describe the different tasks involved in preparing the ecological risk assessment. Ecological risk assessments shall include a level I scoping plan and a level II screening plan; and may include a level III baseline plan and a level IV field baseline plan. The level III and level IV baseline plans shall include an exposure analysis, an ecological response analysis, a risk characterization, and an uncertainty analysis, as required by OAR 340-122-084(3). The ecological risk assessment can be completed using either deterministic or probabilistic methodologies. If probabilistic methodologies are to be used, then Respondents shall obtain DEQ approval of the proposed risk protocol before the commencement of a probabilistic risk assessment.

Terrestrial habitats and receptors shall be evaluated through the following approach:

a. Complete a Level I Scoping assessment per ODEQ guidance for the terrestrial portion of the facility.
b. Make a preliminary determination of locality of the facility with respect to terrestrial receptors and current and potential future exposure to facility-related contaminants.
c. Determine potential for presence/absence of terrestrial threatened or endangered species.

## VI. PHASE I SITE CHARACTERIZATION SUMMARY

The Phase I Site Characterization Summary shall summarize and present preliminary results of the Site Characterization. The summary shall be adequate to allow DEQ to determine whether additional site characterization activities are necessary to complete the RI.

The Phase I Site Characterization Summary shall be based on the results of the remedial investigation and include the following elements:

A. Introduction and Purpose

B. Summary of Site Characterization Activities

C. Summary of Investigation Results

D. Summary of Data Gaps

E. Recommendations and Conclusions

## VII. TECHNICAL MEMORANDUM ON SOURCE CONTROL MEASURES

The Technical Memorandum on Source Control Measures shall present all data relevant to the characterization of migration pathways from the Wacker and GASCO facilities to the Willamette River. The Technical Memorandum shall be developed based on Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, EPA 540/P-91/001 (1993). The Technical Memorandum shall identify any additional data collection activities to be performed during the Phase II RI necessary to complete the characterization of migration pathways. If no additional data are required, the Technical Memorandum shall present and evaluate a set of alternatives for controlling releases to the Willamette River.

The Technical Memorandum on Source Control Measures shall be based on the results of the site characterization and include the following elements:

A. Identification of migration pathways from the Wacker and GASCO facilities to the Willamette River.

B. Characterization of migration pathways from the Wacker and GASCO facilities to the Willamette River

C. Estimate of magnitude of contaminant migration from the Wacker and GASCO facilities to the Willamette River through overland transport, storm water runoff, free phase product migration, direct release, and dissolved groundwater contaminant migration.

D. Identification of alternatives for source control measures to prevent the ongoing migration of contaminants to the Willamette River from the Wacker facility, in coordination with source control measures at the GASCO facility.

E. Evaluation of alternatives for source control measures to prevent the ongoing migration of contaminants to the Willamette River from the Wacker facility, in coordination with source control measures at the GASCO facility.

**VIII. PHASE II REMEDIAL INVESTIGATION WORK PLAN**

Objective: To collect sufficient information to complete the remedial investigation at the facility.

Scope: The Phase II RI Work Plan shall supplement previous investigations at the Wacker and GASCO facilities. The work plan shall be designed complete the characterization of all past, current, and potential releases of hazardous substances at or from the facility.

Procedures: If DEQ determines that additional characterization activities are required to complete the RI, Respondents shall prepare a Phase II RI work plan that addresses all data gaps identified by DEQ. The Phase II RI work plan shall describe all characterization procedures necessary to complete the RI and demonstrate that proposed characterization procedures are sufficient to complete the RI.

**IX. SOURCE CONTROL MEASURES DESIGN PLAN**

Objective: To design necessary source control measures to address contaminant migration to the Willamette River.

Scope: The Source Control Measures Design Plan shall be adequate to implement necessary source control measures to address contaminant migration to the Willamette River from the Wacker facility, in coordination with source control measures at the GASCO facility.

Procedures: The Source Control Measures Design Plan shall be developed in conformance this Scope of Work and, as appropriate, EPA's "Superfund Remedial Design Remedial Action Guidance", OSWER Directive 9355.0-4A, 1986; "Guidance on Expediting Remedial Design and Remedial Action", OSWER Directive 9355.5-02; and any additional guidance documents as directed by DEQ.

The Source Control Measures Design Plan shall include, at a minimum, the following items:

A. Description of proposed Source Control Measures.
B. Proposed schedule for implementation of source control measures.

C. Project organization and identification of reporting relationships, duties, responsibilities, lines of communication, and authorities.
D. Identification and description of design objectives.
E. Identification and description of design criteria and performance standards that shall be applied to the source control measures conducted by Respondents.
F. Identification and listing of federal, state, or local laws, regulations, or guidance applicable to or associated with the source control measures and an explanation of how they will be incorporated into the design and implementation of the source control measures.
G. An identification of permitting requirements and a proposal for satisfying or exempting any applicable requirements.
H. Identification and description of any site access agreements required to implement source control measures.
I. Identification and description of any property, utility, right-of-way, topographic, or other site surveys required.
J. A description of any special design/implementation problems anticipated and how they will be addressed. Include any special technical problems, anticipated community relations problems, access, easements, rights-of-way, transportation, utilities, and logistics problems.
K. A description of all source control measure activities to be performed.
L. Procedures for documentation/validation of source control measures.
M. Description of construction methods and equipment to be used.
N. Description of proposed control measures to minimize releases of hazardous substances to all environmental media during construction or installation activities.
O. Description of any measures necessary to control surface water runoff during construction.
P. Identification and description of dust control and noise abatement measures to minimize and monitor environmental impacts of construction or installation activities.
Q. Identification and description of any site security measures necessary to minimize exposure to hazardous situations during implementation of source control measures.

## X. REMEDIAL INVESTIGATION REPORT

The Remedial Investigation report shall follow the outline in Table 3-13 (page 3-30 - 3-31) in the CERCLA RI/FS guidance, as applicable, and address the items listed below:

A. **Executive Summary.**

B. **Introduction.**

C. **Facility Background.**

A discussion and supporting maps of facility operations, facility description, facility setting, and current and reasonably likely future land and water uses.

D. **Study Area Investigation.**

A discussion of the investigative procedures and results for soil, groundwater, surface water, sediments, and air.

E. **Summary and Conclusions.**

A discussion of the nature, extent, distribution and environmental fate and transport of contaminants in soil, groundwater, surface water, sediments, and air.

F. **Appendices.**

Detailed information supporting the results of the Remedial Investigation shall be submitted in the Appendices of the report.

## XI. RISK ASSESSMENT REPORT

A. **Human Health Risk Assessment Report**

The results of the human health risk assessment shall follow DEQ risk assessment guidance for human health and RAGS-HHEM Part A.

B. **Ecological Risk Assessment Report**

The main sections of the ecological risk assessment report shall follow specific DEQ guidance for report formats at each level (I-III).

## XII. DISTRIBUTION.

A. Three (3) bound copies and one (1) unbound copy of all plans, reports (except Quarterly Reports) and memoranda shall be submitted to DEQ.

B. DEQ requests that all copies be duplex printed on recycled paper.

NWN/203
Witness: Robert Wyatt

# BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

## UG 263

## NW NATURAL

**Exhibit Accompanying Direct Testimony of Robert Wyatt**

**Letter Dated March 21, 2008, from DEQ**

**October 2013**

Oregon
Theodore Kulongoski, Governor

**Department of Environmental Quality**
**Northwest Region Portland Office**
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(503) 229-5263
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March 21, 2008

*Also Sent Via E-mail*

Mr. Robert J. Wyatt
Northwest Natural Gas Company
220 N.W. Second Avenue
Portland, OR 97209

**Subject:** **Groundwater/DNAPL Focused Feasibility Study**
**Shoreline Segments 1 and 2, NW Natural Property and the Northern Portion of the Siltronic Corporation Property**
**Northwest Natural Gas Company**
**Portland, Oregon**
**ECSI No. 183**

Dear Mr. Wyatt:

The Department of Environmental Quality (DEQ) reviewed the "Groundwater/DNAPL Source Control Focused Feasibility Study – NW Natural 'Gasco' Site," received October 12, 2007 and amended November 9, 2007 (Groundwater/DNAPL FFS). Anchor Environmental, LLC prepared the Groundwater/DNAPL FFS on behalf of the Northwest Natural Gas Company (NW Natural). The Groundwater/DNAPL FFS presents NW Natural's evaluation of removal action (i.e., source control measures [SCMs]) alternatives to mitigate migration of groundwater contamination and the movement of dense non-aqueous phase liquids (DNAPLs) to the Willamette River and its sediments. The document also includes a proposal for stabilizing riverbank soils along the shoreline of the property owned by NW Natural (NW Natural Property, or the "Gasco Site"). NW Natural has developed the Groundwater/DNAPL FFS consistent with DEQ Voluntary Agreement No. WMCVC-NWR-94-13 (dated August 8, 1994) as amended by Addendum #1 dated July 19, 2006 (collectively referred to as the "MGP Agreement" in this letter). Under the MGP Agreement, NW Natural is expected to: 1) conduct a remedial investigation (RI) and feasibility study (FS) of releases of manufactured gas plant (MGP) waste[1] and associated contamination (MGP contamination) on the NW Natural Property and the adjoining Siltronic Corporation (Siltronic) property (Siltronic Property); and 2) identify and evaluate SCMs for unpermitted discharges or releases of hazardous substances from the NW Natural Property to the Willamette River.

The primary purpose of this letter is to inform NW Natural that based on our review of the Groundwater/DNAPL FFS and supporting documents, DEQ approves NW Natural's recommendation to implement a hydraulic control/containment system along the shoreline of the NW Natural Property and the northern portion of the Siltronic Property in combination with a vertical barrier in the southern portion of the NW Natural Property to mitigate migration of contamination to the Willamette River by: 1) MGP DNAPL in the fill water-bearing zone (WBZ) and alluvial WBZ; and 2) groundwater in the alluvial WBZ contaminated by dissolved MGP constituents. NW Natural's recommended SCMs alternatives also include contaminants associated with releases from the Siltronic Property where these chemicals have commingled with MGP DNAPL and/or groundwater contaminated by MGP constituents. DEQ does not approve NW Natural's riverbank stabilization proposal.

[1] MGP waste includes production waste and byproducts including, but not necessarily limited to, lampblack, purifier box wastes (spent lime and spent oxides), tar sludge, tar/oil/light oil, tar/oil/water emulsions, and naphthalene.

DEQ approval of NW Natural recommended SCMs alternatives is subject to the conditions detailed in this letter. In addition, this letter provides a brief discussion of DEQ's expectations regarding source control and the upland final remedy; background on the investigative and regulatory status of the NW Natural Property and the northern portion of the Siltronic Property; and DEQ's general and specific comments regarding the Groundwater/DNAPL FFS, including our rational for denying the riverbank stabilization proposal.

Regarding DEQ's expectations of NW Natural for source control and the final upland remedy, several years ago DEQ prioritized source control over the upland RI/FS. The source control strategy involved implementation of source control as a removal action (i.e., interim remedial action measure) in an attempt to cut-off DNAPL and MGP contamination being transported from the uplands to the river via groundwater. Successful timely source control would allow in-water actions to proceed without the immediate risk of recontamination from an uncontrolled upland source. DEQ has always envisioned a second phase of the strategy, a site-wide RI/FS resulting in a comprehensive final remedy.

NW Natural will find in EPA's attached comment letter, concern with the long-term effectiveness of the SCMs alternatives recommended in the Groundwater/DNAPL FFS. EPA strongly believes source area reduction, treatment and/or containment is necessary to ensure the long-term effectiveness of SCMs. DEQ largely agrees with EPA, but believes uplands source area work should be considered in the site-wide RI/FS, and that the recommended SCMs alternatives, subject to DEQ's conditions and comments, should be selected, designed, and constructed as soon as possible (as a removal action, not a site-wide final remedy).

**BACKGROUND**

Consistent with the MGP Agreement, NW Natural is conducting an RI/FS of the Gasco Site and the Siltronic Property. For the Gasco Site, NW Natural has submitted an RI Report[2] and Baseline Risk Assessment[3] that describe the magnitude, nature and extent of MGP waste and contamination in soil and groundwater and evaluate human health and ecological risks resulting from MGP contamination. Both documents are undergoing review by DEQ.

Historically, NW Natural (then known as Portland Gas & Coke [PG&C]) operated an oil MGP, known as the "Gasco Facility," on the NW Natural Property from 1912 until 1956. The Gasco Facility historic production areas corresponded roughly to the locations of the current NW Natural liquid natural gas plant, and the Koppers, Inc. (Koppers) and Fuel and Marine Marketing leaseholds. The Gasco Facility produced MGP waste that was placed in piles (lampblack, spent oxide, and gas purifier piles) and discharged to ponds (effluent discharge, settling, storage, and overflow ponds) located in non-production areas of the Gasco Facility. PG&C also owned much of the current Siltronic Property, the northern-most portion of which was used as an effluent pond during the later stages of the Gasco Facility operations.

Site investigations conducted to date in the uplands and offshore[4] areas of the Gasco Site by NW Natural, and in the northern portion of the Siltronic Property by Siltronic have determined that: 1) the general geology of the area of investigation consists of highly variable fill material overlying alluvium consisting of an upper fine-grained silt unit and deeper mixtures of predominantly fine and medium sands; 2) the fill unit

[2] Hahn and Associates, Inc., 2007, "Remedial Investigation Report, NW Natural - Gasco Facility, 7900 NW St. Helens Road, Portland, Oregon," April 30, a report prepared for NW Natural.
[3] Anchor Environmental, LLC, 2004, "Revised Baseline Ecological and Human Health Risk Assessment Report, NW Natural 'Gasco' Site," December, a report prepared on behalf of NW Natural.
[4] Anchor Environmental, LLC, 2008, "Offshore Investigation Report – NW Natural 'Gasco Site'," February, a report prepared for NW Natural and in review by EPA and DEQ.

is heavily contaminated by MGP waste throughout the former Gasco Facility production and waste management areas; 3) mobile DNAPL occurring in the fill unit and upper silt unit has penetrated into the alluvium beneath the former effluent storage, settling, and overflow ponds (former effluent ponds), and discharge areas; 4) DNAPL occurring in fill and alluvium has a high potential to migrate into the Willamette River in the southern portion of the Gasco Site; 5) in the northern portion of the Siltronic Property, DNAPL associated with a former "effluent pond overflow area" (EPOA) has migrated horizontally towards the river and vertically downward to depths below the bottom of the river channel; 6) MGP waste and contamination have impacted groundwater occurring in the fill (fill WBZ) and underlying alluvium (alluvial WBZ); 7) the fill WBZ and alluvial WBZ are complete groundwater contaminant transport pathways from the uplands to the Willamette River; 8) dissolved MGP constituents are present in groundwater and transition zone water (TZW) at concentrations that significantly exceed relevant Joint Source Control Strategy[5] (JSCS) screening criteria; and 9) historic direct discharge and deposition of MGP contamination has resulted in extensive impacts to river sediments offshore of the NW Natural Property and the northern portion of the Siltronic Property.

NW Natural is moving forward with an RI of MGP waste and associated contamination on the Siltronic Property (Siltronic MGP RI) under a work plan[6] approved by DEQ. The scope of work for the Siltronic MGP RI includes further assessing the nature and extent of MGP waste and contamination and evaluating potentially complete and/or significant human health and ecological exposure pathways in the uplands of the Siltronic Property and to offsite areas, including the Willamette River and Doane Creek.

In addition to MGP waste and contamination on the NW Natural and Siltronic properties, releases from Siltronic's operations have occurred in the northern portion of the Siltronic Property. These releases originated from a former solvent underground storage tank system (Former UST System) and involved trichloroethene (TCE) formerly used by Siltronic, including its breakdown products and additives (collectively referred to as "VOCs" in this letter). Consistent with DEQ Order No. VC-NWR-03-16 (the VOC Order) dated February 5, 2004, Siltronic has conducted a VOC RI[7] that evaluated the lateral and vertical extent of VOCs in soil and groundwater in the uplands; and river sediment, TZW, and groundwater off-shore of the northern portion of the Siltronic facility. The VOC RI also evaluates the potential risk to human health and ecological receptors from exposure to VOCs in soil, river sediment, groundwater, and surface water.

The VOC RI Report documents that: 1) historic releases of VOCs from the Former UST System have impacted the alluvial WBZ beneath the northern portion of the Siltronic facility (i.e., the "VOC Plume"); 2) the VOC Plume has commingled with MGP DNAPL and groundwater impacted by dissolved MGP constituents; 3) groundwater is a complete contaminant transport pathway from the Former UST System to the Willamette River; 4) VOCs are present in groundwater and TZW under the Willamette River at concentrations that exceed JSCS screening criteria, and; 5) significant VOC sediment contamination (i.e.,

[5] EPA and DEQ, 2005, "Portland Harbor Joint Source Control Strategy – Final," December (note Table 3-1 revised July 16, 2007), a guidance document prepared jointly by the US Environmental Protection Agency and Oregon Department of Environmental Quality.
[6] Hahn and Associates, Inc., 2007, "Final Remedial Investigation Workplan, Historical Manufactured Gas Plant Activities - Siltronic Corporation Property, 7200 NW Front Avenue, Portland, Oregon," October 19, a work plan prepared for NW Natural.
[7] Maul Foster Alongi, Inc., 2007, "Remedial Investigation Report, Siltronic Corporation – Portland, Oregon," April 16, a report prepared on behalf of the Siltronic Corporation.

Area 2[8]) is present in the Willamette River within approximately 50 feet northeast of Siltronic's combined storm water/treated wastewater line (i.e., Outfall 001).

**Source Control Determination**

Based on work completed by NW Natural and Siltronic, DEQ determined that the shoreline of the Gasco Site and the northern portion of the Siltronic Property are high priorities for source control. The portion of the shoreline identified as the highest priority for source control (Segment 1) extends from downstream of the "Tar Body Removal Area"[9] (TBRA) on the NW Natural Property, to upstream of the EPOA on the Siltronic Property. This segment coincides with the heaviest MGP-related impacts identified near the river, including DNAPLs, impacted riverbank soils, and contaminated groundwater. It also includes the portion of the Siltronic Property where groundwater contamination caused by Siltronic has commingled with MGP-related DNAPL and groundwater contamination resulting from the former operations of the Gasco Facility. The segment of NW Natural's shoreline between the TBRA and NW Natural's downstream property line with US Moorings (Segment 2) is considered a high priority for source control primarily due to the presence and concentrations of MGP chemicals of interest (COI), particularly cyanide, in riverbank soils and groundwater. A third shoreline segment (Segment 3) extends from upstream of the EPOA to the upstream Siltronic Property line. A source control evaluation of Segment 3 is ongoing.

**NW Natural and Siltronic Focused Feasibility Studies**

The Groundwater/DNAPL FFS evaluates and recommends SCMs alternatives along shoreline segments 1 and 2 to mitigate contamination migrating to the Willamette River including, MGP DNAPL in the fill WBZ and alluvial WBZ and groundwater in the alluvial WBZ contaminated by dissolved MGP constituents. The document also includes a proposal to repair and/or stabilize riverbank soils along the shoreline of the NW Natural Property.

The Groundwater/DNAPL FFS evaluates SCM alternatives prior to initiation of the MGP FS. The document does not propose final remedial action(s) for MGP waste and/or MGP contamination occurring in the Gasco Site and Siltronic Property uplands. The final remedial action(s) for MGP waste and contamination will be selected as an outcome of the uplands MGP RI/FS for the NW Natural and Siltronic properties. DEQ considers implementation of SCMs necessary to control ongoing and future migration of DNAPL and contaminated groundwater to the river during the time the uplands RI/FS is being completed and in-water actions are being planned.

Regarding the VOC Plume in the northern portion of the Siltronic Property, per the VOC Order, Siltronic submitted a VOC Plume FFS[10] that evaluated and recommended SCMs alternatives for the northern portion of the Siltronic Property to mitigate VOC contamination migrating to the Willamette River and its sediments via the groundwater pathway. The geographic area covered by the VOC Plume FFS overlaps with the Groundwater/DNAPL FFS in the northern portion of the Siltronic Property where commingling of MGP DNAPL, MGP contamination, and VOCs has occurred.

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[8] Based on uplands and in-water investigations completed to date. Area 2 does not appear to be associated with the VOC Plume. Siltronic suspects Area 2 is the result of historic releases to the storm water conveyance system from a TCE stripper system formerly used at the facility.

[9] The "Tar Body Removal Area" is a features associated with the historic operation of the former Gasco Facility. The TBRA was subject to an EPA early action conducted in the late-summer/early-fall 2005.

[10] Maul Foster and Alongi, 2007, "Focused Feasibility Study - Siltronic Corporation, Portland, Oregon" October 23 (amended December 19, 2007), a document prepared for Siltronic, Corporation.

The VOC Plume FFS evaluated six SCMs alternatives that fell under four general categories: 1) no action; 2) use of enhanced in-situ bioremediation (EIB) treatment technologies along the riverbank and in the vicinity of the Former UST System; 3) use of EIB in the Former UST System vicinity combined with hydraulic containment along the shoreline; and 4) hydraulic containment alone along the shoreline. In a letter dated February 14, 2008, DEQ selected SCMs alternatives for the VOC Plume that involve use of EIB in the Former UST System vicinity (i.e., the source of the VOC release[s]) combined with hydraulic control and containment along the shoreline.

DEQ informed Siltronic they should move forward with the work necessary to scale-up EIB in the vicinity of the Former UST System and contribute to planning and implementation of contaminant migration control and containment SCMs along the riverbank. Particular attention will be paid by Siltronic to portions of the VOC Plume that could occur outside the control/containment SCMs being evaluated by NW Natural (i.e., VOCs occurring beyond the margins of MGP contamination).

Neither the Groundwater/DNAPL FFS nor the VOC Plume FFS address contamination resulting from historic discharges and/or deposition of MGP waste, MGP contamination, and/or VOCs in the Willamette River. NW Natural and Siltronic acknowledge that offshore contamination will require in-water action(s) that are beyond the scope of either FFS. Impacts to the Willamette River and its sediments requiring in-water action(s) are subject to oversight by the U.S. Environmental Protection Agency (EPA).

**Joint Order**

DEQ Order No. ECVC-NWR-00-27 (the Joint Order) dated October 4, 2000, requires NW Natural and Siltronic to, "...identify, characterize, and evaluate any unpermitted discharge or migration of contaminants to the Willamette River or its sediments identified in the RI, and, as necessary, develop and implement source control measures to address such releases." Under the Joint Order and consistent with the JSCS, DEQ considers both companies responsible for: 1) identifying complete contaminant transport pathways from the Siltronic Property to the Willamette River and sediment; and 2) evaluating SCMs alternatives for high priority pathways.

Currently, EPA and DEQ consider the off-shore areas of the Siltronic and NW Natural properties to be a potential candidate for early action. DEQ prioritized source control after determining it will be unlikely the uplands RI/FS of MGP waste and contamination on the NW Natural and Siltronic properties will be completed by the time the Record of Decision for Portland Harbor has been finalized (currently projected for 2010). As such, DEQ established short-term source control goals for the most heavily impacted portions of the Siltronic and NW Natural shorelines, including: 1) evaluating and selecting SCMs that effectively mitigate contaminant migration to the river; 2) expediting planning and design of the SCMs; 3) finalizing design(s) and implementing SCMs in coordination with EPA, but in advance of in-water action(s). DEQ considers the Groundwater/DNAPL FFS and VOC Plume FFS completed by NW Natural and Siltronic respectively, to have been prepared consistent with these goals.

DEQ also considers it a priority for the uplands MGP RI/FS to move forward concurrently with development and implementation of the SCMs. The MGP FS will include evaluation of proven, effective, and feasible remedial action alternatives for addressing MGP contamination in the uplands portions of the NW Natural and Siltronic properties. DEQ informed NW Natural and Siltronic that during the time it takes to complete uplands work, it is essential for the companies to select and implement compatible SCMs to meet the

requirements of the Joint Order, and the goals of the JSCS for MGP contamination and VOCs migrating to the river.

**DNAPL/GROUNDWATER FOCUSED FEASIBLITY STUDY**

DEQ's selection of SCMs alternatives, the conditions for moving forward with planning and design of SCMs, and our comments on the Groundwater/DNAPL FFS are provided below. Because source control-related work has been prioritized, DEQ's reviews of the Gasco Site RI Report and Baseline Risk Assessment are ongoing and a comments letter pertaining to both documents will be prepared subsequent to our review of the Groundwater/DNAPL FFS.

Given the status of the NW Natural and Siltronic properties in the Portland Harbor, DEQ provided copies of the Groundwater/DNAPL FFS to the EPA. In addition, the Oregon Department of State Lands (DSL) and the Tribe's shared consultant[11] requested copies. The DSL did not provide comments to the document. Copies of the EPA's and Tribe's consultant's comments are attached. In addition, given the DNAPL/Groundwater FFS proposes SCMs on the Siltronic Property, Siltronic provided comments to the document as well. Given EPA's role in the Portland Harbor, their February 8, 2008 letter should be of particular interest to NW Natural. The EPA provides comments directly applicable to the Groundwater/DNAPL FFS (see comments #1 [the third paragraph], #2,, #3, #4, #5, #6, and #8), and comments that NW Natural should address during the upland MGP RI/FS (see comments #1, #3, #6, and #7).

DEQ considered all of the reviewer's comments in preparing this letter, and although the DEQ, EPA, and Tribe's consultant share many comments, NW Natural should closely review the attachments so all comments are considered during preparation of future documents, when developing plans for SCMs, and during upland MGP RI/FS work.

The Groundwater/DNAPL FFS evaluates SCMs alternatives scenarios to control and contain DNAPL and contaminated groundwater along the shoreline of the NW Natural Property and the northern portion of the Siltronic Property (i.e., shoreline segments 1 and 2). Based on the results of the source control technologies screening evaluation presented in Section 6 of the document, vertical barriers and hydraulic control/containment were identified as SCMs alternatives for segments 1 and 2. DEQ accepts the outcome of the source control technology screening given the goals of the Groundwater/DNAPL FFS were to identify SCMs alternatives that are proven and effective at controlling and containing DNAPL and groundwater contamination and implementable within time-frame supportive of the uplands RI/FS schedule and future in-water actions. In addition, well-based hydraulic control/containment systems are operationally flexible and can be expanded depending on project need. DEQ also anticipates control/containment technologies will be a component of the final remedy because during, and for some time after, remediation of upland source areas, groundwater contamination will continue migrating towards the river and need to be intercepted.

NW Natural should be aware that given the SCMs alternatives evaluated in the Groundwater/DNAPL FFS do not address upland sources of contamination; DEQ does not recognize them being effective long-term remedial action alternatives for the MGP waste and MGP contamination on the Gasco Site and in the northern portion of the Siltronic Property. For clarification, DEQ regards many of the source control

[11] Stratus Consulting, Inc. reviewed the VOC Plume FFS on behalf of the Confederated Tribes of Grand Ronde, Siletz Department of Natural Resources, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of Warm Springs.

technologies dismissed as SCMs alternatives in the FFS to be legitimate remedial action alternatives for the upland FS. DEQ expects that an effective long-term remediation strategy of uplands source areas will involve combinations of remedial technologies (e.g., mass removal/reduction, containment, treatment) depending on the location, magnitude, nature, and extent of contamination.

NW Natural evaluated SCMs alternatives scenarios for both segments 1 and 2. The list of alternatives for the two segments was similar and generally included the following:

- Alternative 1 – hydraulic control/containment alone;
- Alternative 2 – rigid vertical barrier alone (based on the sheet-pile construction methodology);
- Alternative 3 – non-rigid vertical barrier alone (based on the slurry wall method of construction);
- Alternative 4 - hydraulic control/containment combined with a rigid barrier; and
- Alternative 5 – hydraulic control/containment combined with a non-rigid barrier.

NW Natural further evaluated three variations of Alternative 4 and Alternative 5 for Segment 1 that involved varying the length (entire or partial length of Segment 1) and depth (65 feet or 85 feet below ground surface [bgs]) of vertical barrier(s).

In sections 7 and 8 of the Groundwater/DNAPL FFS, NW Natural compares each SCM alternative to DEQ balancing factors. In addition, NW Natural considered two other factors in the evaluation, including: 1) the ability of SCMs to prevent river recontamination, and 2) compatibility of SCMs with in-water actions. From review of the Groundwater/DNAPL FFS, DEQ further understands NW Natural's SCMs alternatives recommendations were influenced by the following significant technical findings.

- Variation in depth of mobile DNAPL in the alluvial WBZ along Segment 1.
  - In the southern portion of the NW Natural Property, the lower elevation range of DNAPL occurrence is between approximately -42 and -50 feet mean sea level (msl), or roughly 4 to 12 feet below the navigation channel.
  - On the Siltronic portion of Segment 1, the upper elevation range of DNAPL occurs between approximately -72 and -82 feet msl (i.e., 32 to 42 feet below the bottom of the channel).
- Absence of mobile DNAPL in the fill and alluvial WBZs along Segment 2.
- Preliminary modeling work suggests the proposed hydraulic control/containment system can capture groundwater over the full thickness of the alluvial WBZ across both shoreline segments.

Based on the SCMs alternatives analysis, NW Natural recommended the following combination of SCMs in segments 1 and 2 (see Section 9):

- Segment 1 - hydraulic control/containment using extraction wells along the entire segment combined with a vertical barrier that extends across the southern 625 feet of the NW Natural Property and constructed to a depth equivalent of approximately -40 msl (Alternative 4C); and
- Segment 2 – hydraulic control and containment using extraction wells across the entire segment (Alternative 1).

NW Natural indicates in Section 9 the recommended SCMs alternatives that scored the highest are proven and implementable, and will effectively meet the source control RAOs by: 1) completely capturing, controlling, and containing groundwater contaminated by MGP constituents over the full thickness of the alluvial WBZ beneath shoreline segments 1 and 2; and 2) placing a vertical barrier across the portion of shoreline segments 1 and 2 where DNAPL has the highest potential to migrate to the Willamette River. Additionally, the recommended SCMs alternatives include VOCs where commingling of these chemicals with DNAPL and/or groundwater contaminated by MGP constituents has occurred.

**Source Control Measures Evaluation and Selection**

Based on review of the Groundwater/DNAPL FFS, DEQ agrees with NW Natural's recommended SCMs for Segment 1 (Alternative 4C) and Segment 2 (Alternative 1). For clarification, DEQ is only approving the general application of these technologies, and not the details implied by supporting discussions and figures presented in the document. The details and design of SCMs including the length, depth, alignment, and construction method(s) for the vertical barrier, and the numbers, locations, and depths of extraction wells will be determined subsequent to completion of additional field investigations and data review and analysis. Additional investigations are needed to further delineate the distribution of DNAPL near the shoreline (e.g., subsurface geologic and DNAPL logging), evaluate barrier construction methods (e.g., vibration testing, geotechnical studies), and support overall SCMs design (e.g., groundwater modeling).

DEQ does not approve of the riverbank stabilization proposal provided in Appendix F for reasons discussed further under "General Comments."

**Source Control Measures Planning and Design**

NW Natural should move forward with the work necessary to design the Segment 1 and Segment 2 SCMs subject to the conditions provided below. Many of the conditions reflect DEQ's review of the Targost® work completed in August-September 2007. Targost® logging equipment was used to support the SCMs alternatives evaluation, and the data was presented for the first time in the Groundwater/DNAPL FFS. Use of the Targost® equipment provided data to confirm the former effluent ponds are sources of mobile DNAPL to the fill WBZ and alluvial WBZ, and further characterize the horizontal and vertical distribution of DNAPL within Segment 1. The investigation also documents that DNAPL has migrated away from former effluent ponds towards the river and vertically downward. DEQ concludes based on the Targost® work that the hydraulic control/containment SCMs could potentially mobilize and spread DNAPL. DEQ previously informed NW Natural that potential expansion of the distribution of DNAPL is a significant factor for SCMs planning and design. As a consequence of these findings, DEQ expects NW Natural to do the following.

- The RAO for Segment 1 should be revised to:
  - Clarify that SCMs alternatives have been evaluated specific to mitigating migration to the Willamette River along shoreline segments 1 and 2 by DNAPL in the fill WBZ and alluvial WBZ, and contaminated groundwater in the alluvial WBZ. Groundwater in the fill WBZ is not addressed except as a consequence of constructing the vertical barrier (see the second bullet in the second group of bulleted items below).
  - Include DNAPL removal to the extent necessary to control and contain the potential movement of DNAPL from former effluent ponds on the NW Natural and Siltronic properties that could result from operation of the hydraulic control/containment system.
- Additional Targost® work should be performed to further evaluate the horizontal and vertical extent of DNAPL in areas potentially influenced by operation of the hydraulic control/containment system, including, but not necessarily limited to:
  - Between borings TG-1 and TG-2 to refine the location of the northern end of the vertical barrier;
  - Beneath the effluent settling, discharge, and/or overflow ponds in the southern portion of the NW Natural Property and the northern portion of the Siltronic Property (e.g., between Targost® borings TG-7 and TG-8, TG-3S and TG-4S, at GP02-03, and southwest of TG-3S/TB-5S/TB-6S and TG-8).
- In previous correspondence and meetings, DEQ informed NW Natural that technical justification is needed to validate their assumption that DNAPL occurring below the bottom of the channel will not

migrate into the river. To date, NW Natural has not responded adequately to DEQ's request. Absent a satisfactory analysis, DEQ will expect the initial design depth of the vertical barrier proposed in the southern portion of the NW Natural Property to be no less than 10 feet below the bottom of the deepest occurrence of DNAPL (i.e., approximately -60 feet msl). See DEQ's specific comment to "Sections 6.2.1, 6.6.1, and 7.1.2.1 (and elsewhere)" for additional information.

DEQ acknowledges the Groundwater/DNAPL FFS has been prepared to evaluate SCMs alternatives and is not intended as a design document. However, DEQ will expect the following design elements and technical evaluations to be included in vertical barrier construction planning.

- The SCMs alternatives evaluation presented in the Groundwater/DNAPL FFS focused on sheet pile and slurry wall construction methods. DEQ understands that the sheet pile construction method is preferred by NW Natural. NW Natural and Siltronic acknowledge the potential exists for sound and vibrations caused by driving sheet piles to negatively impact Siltronic's operations. The two companies are currently developing approaches for conducting and monitoring tests to assess potential vibration effects. For clarification, DEQ expects additional construction methods (e.g., poured piles, deep soil mixing) to be included in the vibration testing and monitoring plans being prepared. Additional discussion of this condition is provided in DEQ's comment to Section 3.3.4.
- The vertical barrier alignment crosses the former source of direct discharges to the TBRA. As such, the barrier will be constructed through fill material heavily impacted by MGP waste. Given this information, engineering controls will be needed in the fill WBZ on the upland side of the barrier to prevent DNAPL and/or contaminated groundwater from moving over or around the barrier (e.g., fully penetrating DNAPL/groundwater collection trench in the fill WBZ).
- Regardless of the construction method used, the barrier will require drilling and/or excavating through fill that is heavily impacted by MGP waste. DEQ will expect a method to be developed to effectively seal the fill from the underlying alluvium during construction to minimize cross-contamination (e.g., chemically compatible slurry-filled trench or pilot holes).
- Along the alignment of the vertical barrier, NW Natural proposes to position extraction wells below the bottom of the vertical barrier. According to NW Natural, the vertical barrier will block lateral movement of mobile DNAPL towards the river, and extraction wells will reverse the hydraulic gradient and induce groundwater to flow from the river back towards the uplands. NW Natural asserts that gradient reversal will prevent mobile DNAPL from migrating to the river. DEQ does not approve this approach as the extraction wells are placed below the barrier and DNAPL, increasing the potential for coalescence and downward vertical migration of DNAPL. The vertical barrier should be fully integrated into the hydraulic control/containment system by placing additional extraction wells above the bottom of the barrier. This arrangement will increase horizontal and upward vertical gradients operating behind the barrier, and reduce the likelihood DNAPL will migrate below and beyond the influence of deeper extraction wells.
- From a conventional standpoint the vertical barrier proposed by NW Natural is a "hanging wall" (i.e., a vertical barrier that is not keyed into low permeability material at depth). However, the stratigraphy of the alluvium beneath the silt unit along Segment 1 is variable, consisting of mixtures of fine and medium sand with lesser amounts of silt. DEQ will expect NW Natural to conduct a detailed analysis of available information (e.g., boring logs, grain-size analyses, CPT logs) to evaluate whether there are fine-grained layers, or packages of fine-grained sediments of overall lower permeability that could serve as a "key" for the bottom of the barrier. NW Natural should be aware that based on the review of available information, DEQ could require additional field data collection (e.g., collect samples for vertical permeability testing) to further evaluate this situation.

DEQ also has conditions regarding effectiveness monitoring and riverbank work that NW Natural should incorporate into SCMs planning and design.

- Section 11.2 provides NW Natural's general recommendations regarding SCMs effectiveness monitoring. DEQ concurs with NW Natural that the monitoring program should be designed to monitor SCMs performance and determine whether the RAOs are being achieved. NW Natural indicates that this should involve measuring physical parameters only, primarily groundwater and DNAPL levels in extraction and monitoring wells. Regarding the hydraulic element of the performance monitoring program, DEQ expects additional installations will be needed and recommends NW Natural consult with recently published EPA guidance[12] regarding this topic.

  DEQ disagrees with NW Natural that chemical measures are not needed to monitor SCMs performance. DEQ acknowledges that because SCMs will be surrounded by MPG waste and MGP contamination, SCMs performance cannot be solely based on monitoring MGP constituent and/or VOC concentrations or trends. However, NW Natural and DEQ have discussed using chemical measures to evaluate physical control and containment of contaminated groundwater in the alluvial WBZ (i.e., DEQ "hot spot" levels and JSCS Table 3-1 criteria). DEQ expects these concentration criteria to be carried forward into SCMs planning and design work, and used as a basis for assessing performance. Furthermore, chemical monitoring will be required to evaluate the effectiveness of the groundwater treatment system in achieving discharge limits that are in development. Based on this information, DEQ considers chemical analysis of groundwater samples and physical measurements to be essential for monitoring SCMs performance. Chemical monitoring should include, but is not limited to, analyzing groundwater samples from extraction wells and/or monitoring wells for:
  - Typical field measured water quality parameters;
  - Inorganic analytes indicative of surface water and groundwater chemistry;
  - COI for the Gasco Site and Siltronic facility (e.g., polycyclic aromatic hydrocarbons; VOCs, metals);
  - All parameters on the groundwater treatment system discharge list, and
  - Any additional constituents that could influence extraction well and/or groundwater treatment system operation and performance.

  Along with physical measurements, chemical monitoring is needed to provide data to assess the timing and degree of interaction between the extraction well network and the river, monitor concentrations trends at extraction wells, support evaluations of contaminant capture and mass removal estimates, and track groundwater extraction and treatment system performance and operations. Ultimately, sufficient physical and chemical data must be collected to determine SCMs are achieving performance objectives (e.g., full vertical capture of the alluvial WBZ, reversing groundwater gradients in the alluvial WBZ, controlling/containing DNAPL in the fill and alluvial WBZs and within former effluent ponds).

- Planning, design, and implementation of the vertical barrier and hydraulic control/containment SCMs must take into consideration future riverbank work that could include bank repair, excavation and removal, replacement, and/or stabilization. DEQ considers it unacceptable for future riverbank work to interfere with construction of the vertical barrier, installation and/or operation of extraction wells and/or DNAPL/groundwater treatment system equipment, buildings, or piping. Likewise, SCMs should not limit NW Natural's ability to develop a complete and effective approach to stabilizing the riverbank and

[12] U.S. Environmental Protection Agency, 2008, "A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems – EPA 600/R-08/003," January, a guidance document prepared for use by technical professionals involved in sites using pump and treat systems.

preventing erosion of contaminated soils. This condition is further discussed under "General Comments."

**General Comments**

The results of preliminary modeling presented in Appendix E indicate that 10 extraction wells installed to a depth of approximately 85 feet bgs and pumping at a rate greater than 14 gallons per minute (gpm) will completely capture groundwater over the vertical extent of the alluvial WBZ. DEQ considers this a significant finding of the Groundwater/DNAPL FFS that warrants additional analysis, including, but not necessarily limited to:

- Documenting that the basalt underlying the alluvial WBZ can be represented as a "no flow boundary" (i.e., does not contribute water to the model) using data or published reports.
- Using independent methods confirm that the total groundwater flux through the alluvial WBZ is approximately 200 gpm (i.e., the combined pumping rate of the extraction wells to achieve complete capture).
- Explaining the apparent contradiction between the NW Natural's conclusion that the river caused rapid stabilization of drawdown observed during PW-04 performance tests, and modeling results that suggest complete vertical capture of alluvium is achievable.
- Evaluating the increase in hydraulic conductivity with depth (10 feet/day versus 200 feet/day) as an alternative to the river as the cause of rapid drawdown stabilization observed during performance testing.
- Hydraulic property assignments are not provided in tables or shown on figures, and should be for completeness. Without this information DEQ cannot assess how the data generated for the site have been used to construct the model.

These items require clarification to determine whether the preliminary model grid and input parameters adequately represent the groundwater system, and before the model is carried forward and used for future SCMs planning and design work.

Appendix F provides NW Natural's proposed evaluations of interim riverbank stabilization alternatives for the Gasco Site. The objective of the evaluation is to identify measures to stabilize the slope and control potential erosion of the bank and transport of the underlying impacted soil to the river. NW Natural describes riverbank stabilization measures as, "...interim measures that could become a permanent remedy for shoreline stabilization of soils pending agency approval." Depending on location along the shoreline, NW Natural proposes three general approaches for the riverbank, including no action, repairing existing riprap, and use of engineered slope stabilization technologies. DEQ considers the proposal incomplete for the following reasons:

- Appendix F references documents containing analytical data for riverbank sampling work completed previously. The bank stabilization evaluation needs to provide the information for completeness. The evaluation should incorporate data for soil samples collected on or near the riverbank so DEQ can: 1) evaluate whether sufficient data are available for project planning; 2) determine whether data have been compared to appropriate screening criteria; and 3) review bank stabilization recommendations in the context of the nature and extent of soil impacts.
- The recommendations focus on engineering improvements only, and do not assess measures (e.g., removal), or the need for measures to reduce riverbank soil contamination.
- Section 2.1 of the proposal indicates that the combination of the vertical barrier and hydraulic control/containment SCMs will eliminate groundwater seepage through the riverbank. Based on DEQ's understanding of the conceptual site hydrogeologic model, the fill WBZ represents the source of groundwater seeping through the riverbank. Given the hydraulic control/containment system is

constructed in the alluvial WBZ, it is unclear how elimination of seepage through the riverbank would occur. Absent information, data, and/or analysis that the alluvial WBZ extraction wells will also control/contain the fill WBZ along the shoreline, DEQ will expect the bank stabilization project to include this as an RAO.

DEQ concurs with NW Natural that planning, design, and implementation of the vertical barrier and hydraulic control/containments system are higher priorities than, and should move forward separately from the riverbank work. DEQ notes in Section 1.3 of the riverbank proposal that, "...there are some reaches of the shoreline where subsequent bank stabilization measure could interfere with groundwater source control measures..." DEQ has made NW Natural's implementation of a vertical barrier and hydraulic control/containment system contingent on satisfying two conditions: 1) future riverbank work will not interfere with implementation of SCMs; and 2) the SCMs preserve maximum flexibility in accommodating the range of options for bank soil and river sediment removal and/or stabilization. NW Natural should revise and resubmit a bank stabilization proposal that incorporates DEQ comments. The revised proposal should include figures comparing the locations of SCMs, including treatment system buildings and piping, with setbacks needed to accommodate riverbank work areas. Prior to revising the document, DEQ and NW Natural should meet to discuss and clarify the project's scope, goals, and objectives.

**Specific Comments**

In addition to the conditions and general comments listed above, DEQ has specific comments regarding the Groundwater/DNAPL FFS. These comments relate to planning, design, and implementation of the vertical barrier and hydraulic control/containment combination and future submittals.

**Section 2.2.** DEQ agrees with NW Natural that the MGP FS will evaluate remedial action alternatives for uplands soils and surface water. DEQ also anticipates that the vertical barrier and hydraulic control and containment system will be components of the final remedy. NW Natural should be aware that the MGP FS will need to fully evaluate performance of these SCMs and compare them to other alternatives so that a final groundwater pathway remedy can be selected. DEQ has made it clear that these measures alone will not be sufficient as a final remedy as they do not involve removal and/or treatment of uplands source areas on the Gasco Site and the Siltronic Property (e.g., former effluent ponds).

**Section 3.2.12.** The second to the last paragraph of this section suggests the VOC Plume influences the mobilization of MGP contamination. As DEQ has indicated in previous correspondence, to support this supposition NW Natural needs to collect the appropriate DNAPL data (e.g., composition, viscosity, specific gravity, wettability, interfacial tensions, and saturations), calculate the concentration of VOCs needed to increase mobility, compare calculated concentrations for available data, and present the findings and conclusions to DEQ for review.

**Section 3.3.2.** See DEQ's comments to Appendix E.

**Section 3.3.3.** NW Natural indicates the absence of free cyanide in surface water signifies SCMs may be unnecessary, or that the objectives of source control should be revisited. DEQ disagrees with this assertion and considers it premature given that the forms, stability, and toxicity of cyanide compounds, as well as their mass loading to the river have yet to be determined and/or characterized.

**Section 3.3.4.** According to NW Natural, the feasibility or recommendation of a SCM can not be fully evaluated before vibration issues are resolved. Sheet piles are used to evaluate a rigid barrier SCM in the

Groundwater/DNAPL FFS. DEQ considers this method to have a high potential for producing vibrations relative to other methods. The scope of vibration testing should evaluate other construction methods with the goal of identifying alternatives that are effective, feasible, and implementable. Vibration will certainly factor into this evaluation. DEQ expects NW Natural to evaluate several barrier construction methods simultaneously so that in the event the use of steel sheet pile is restricted, an alternate method of barrier construction (slurry walls, poured pilings) can be substituted with little to no delay in the implementation of SCMs.

**Section 4.0.** NW Natural evaluates SCMs alternatives using DEQ balancing (and other) factors, but not by protectiveness, which is a primary factor in an FS. NW Natural should be advised that protectiveness will need to be included at some point in the future, likely when the final upland and/or in-water remedies are defined.

**Section 4.2.1.** NW Natural identifies controlling and containing DNAPL and groundwater migration to the river as the two primary physical goals for source control. The goal for groundwater is described as controlling groundwater gradients in the alluvial WBZ to "...result in near zero groundwater discharge to the river." NW Natural indicates in the second paragraph that, "...such level of control [near zero discharge] is not necessary to prevent dissolved plume migration to the river..." In later sections of the Groundwater/DNAPL FFS (see sections 7.7.1 and 8.8.1), NW Natural discusses the results of preliminary modeling that suggest complete vertical capture of the alluvial WBZ is achievable. For clarification, DEQ understands the goal of achieving complete capture of the alluvial WBZ will be carried forward into planning SCMs and developing the performance monitoring program based on the following information presented in the Groundwater/DNAPL FFS.

- The hydraulic control/containment system shown in Figure 7 is configured for complete capture at extraction rates greater than 140 gpm; and
- NW Natural indicates the system will be designed for much higher extraction rates.

Later in the fourth paragraph, NW Natural indicates that, "In general, if an interim source control alternative meets the primary removal action goals, it can be assumed that virtually no residual risk from groundwater/DNAPL source exists." The RAOs for the Groundwater/DNAPL FFS are to control and contain ongoing and future migration of DNAPL and contaminated groundwater to the river. As modified by the conditions in this letter, the RAOs also include removing DNAPL as necessary to achieve these objectives. Without treatment and/or removal of upland sources, particularly DNAPL, the implementation of SCMs will not reduce risk related to the contamination present in uplands soil and groundwater, and in sediments, TZW, and groundwater under the river will remain in-place essentially unaffected. Until upland source areas of contamination are remediated consistent with a site ROD, and in-water actions are completed, the risk of exposure to human health and ecological receptors in the uplands and in the river will exist.

**Section 6.2.1.** NW Natural indicates that the results of the Targost® logging work, "...do not indicate that the Site DNAPL occurs in thick pools..." DEQ disagrees with this interpretation. DEQ interprets the data to indicate that DNAPL has accumulated beneath former effluent ponds. Depending on location, DNAPL occurs nearly continuously over vertical depth intervals of many feet (e.g., TG-8, TG-3S). Furthermore the data indicate mobile DNAPL is migrating away from the ponds (horizontally and vertically). As discussed under DEQ's General Comments, based on the results of Targost® logging, the RAO for Segment 1 has been expanded to included DNAPL removal in selected areas to reduce DNAPL mobility. DEQ will also expect the upland site-wide FS to include remedial action alternatives that remove subsurface DNAPL.

**Sections 6.2.1, 6.6.1, and 7.1.2.1 (and elsewhere).** NW Natural asserts that: 1) gravitational forces will prevent DNAPL from migrating upward into the river, 2) the effective depth of the barrier should coincide with the bottom of the river channel; and 3) hydraulic gradient reversals resulting from the extraction well network will effectively control DNAPL movement. DEQ expects NW Natural to fully evaluate potential DNAPL mobility using reasonable site-specific ranges of DNAPL properties and occurrence, and horizontal and vertical gradients operating under natural and induced conditions. Critical or threshold gradients for horizontal and vertical DNAPL movement and safety factors should be determined and integrated into the analysis. The results should be presented graphically, including showing the distribution and occurrence of DNAPL relative to the horizontal and vertical extent of the hydraulic control/containment capture zone. Unless conclusive information, data, and/or analysis can be provided to justify an alternative completion depth, the bottom of the vertical barrier should be at least 10 feet below the deepest occurrence of DNAPL near the Gasco Site shoreline for planning purposes. The final depth will be based on the depth of occurrence, distribution, and mobility of DNAPL, the stratigraphy of the alluvium, and the vertical barrier construction method.

**Section 6.6.1.** NW Natural indicates that vertical barrier construction methods other than sheet pile and slurry wall are unproven, and have greater potential for gaps to occur in the barrier. DEQ considers alternative barrier construction methods (e.g., deep soil mixing, poured piles) to have advantages over the sheet pile approach. As noted by NW Natural, alternative methods can achieve greater depths than sheet pile, and more importantly, alternative methods are known to produce less vibration than sheet piles. As indicated above, DEQ will require alternative barrier construction methods to be retained for further evaluation during vibration testing, and SCMs planning and design.

NW Natural notes that the depth barrier construction methods can achieve is not factor because all reviewed technologies can reach the depth of the river bottom. As indicated above, DEQ is requiring the bottom of the vertical barrier to be placed at -60 feet msl for preliminary planning purposes. Construction methods should be evaluated against this depth criterion. As such, depth of implementation may still be a factor in the selection process.

**Section 6.6.2.** For clarification, NW Natural and DEQ discussed vertical barriers as being a proven DNAPL containment technology for MGP sites, and agreed it was feasible to implement the technology on the NW Natural and Siltronic properties. Furthermore, both parties agreed vertical barriers should be evaluated in the Groundwater/DNAPL FFS as a SCMs alternative.

**Section 7.1.1.** DEQ has requested additional information regarding the preliminary model developed for the Groundwater/DNAPL FFS. A significant finding of the modeling work is that groundwater in the alluvial WBZ can be completely captured. Groundwater treatment costs are dependent on both the total flow rate and contaminant mass. As such, it is important for NW Natural to verify the anticipated range of total pumping rates for the extraction well network (i.e., total groundwater flux through the alluvial WBZ) and the associated treatment costs.

**Section 7.1.2**. This section re-states NW Natural's perceived RAO of preventing DNAPL from directly discharging to the Willamette River. However, it is implied that continued migration of DNAPL to areas beneath the river is an acceptable condition. For clarification, DEQ considers DNAPL beneath the river to represent a potential ongoing source of dissolved-phase contamination that should be considered during in-water action planning.

**Section 7.1.3.** The formulation of the slurry mix, possibly including cement, should consider future remedial work at the site. For example, the strength of the slurry wall may need to support construction activities and/or future efforts to remove riverbank material.

**Section 7.2.2.3.** For clarification and planning purposes, DEQ has previously determined that historic releases of VOCs from Siltronic's Former UST System to soil and groundwater are F002 listed hazardous waste.

**Sections 7.2.2 and 7.2.5.** NW Natural indicates that groundwater extraction wells alone, "... would be expected to contain DNAPL due to these gradient changes." DEQ disagrees due to the difficulty involved in fully characterizing the distribution, occurrence, mobility, and movement of DNAPL. Adding extraction wells on upland side of the barrier and within effluent ponds reduces uncertainty and increases SCMs effectiveness through removal of DNAPL in source areas and increased gradient control.

**Sections 7.2.3.3 and 10.0.** Based on observations made during uplands and in-water drilling and sampling work, agitation of sediments during construction of the vertical barrier could cause NAPL releases into the river. NW Natural should be advised that at another Portland Harbor site (i.e., ARCO Bulk Terminal 22T [ECSI #1528]), the National Oceanic and Atmospheric Administration (NOAA) "required" coordination to minimize potential takes of Endangered Species Act fish caused by upland sheet pile wall installation (e.g., in-water contaminant releases due to vibrations) even though in-water-permitting was not required. DEQ will expect NW Natural to contact NOAA to discuss this scenario, and include contingencies for mitigating in-water releases caused by barrier construction in the draft design document.

**Section 7.2.4.4.** Regarding river recontamination, except for a slightly higher potential for gaps to occur, NW Natural indicates a slurry wall would perform identically to a sheet pile barrier. From an engineering standpoint, DEQ considers a slurry wall to be less compatible than a sheet pile wall with future remedial work potentially involving riverbank stabilization work and/or removal of heavily impacted soil and/or sediment riverward of the barrier.

**Section 7.2.5.** This section provides contradictory information regarding DNAPL mobility. NW Natural implies that density differences between DNAPL and water are so slight as to allow reliable containment by pumping wells. However, in Section 6.6.1 NW Natural indicates that density contrasts are large enough to prevent DNAPL from migrating upward into the river. Regardless, DEQ is expecting and evaluation of DNAPL mobility and movement to be performed during SCMs planning and design.

**Section 7.3.3.** DEQ acknowledges that there are existing structures and subsurface conditions along the shoreline that could interfere with SCMs construction. While they are implementation considerations, existing structures can be temporarily removed (e.g., catwalks) and/or realigned (piping) to accommodate construction. DEQ agrees with NW Natural that removal of subsurface obstructions will likely be required to prepare the shoreline for SCMs construction.

**Section 7.4.2.** DEQ's comments to Section 7.1.1 apply here.

**Section 9.2.1.** The last sentence of the third paragraph indicates that, "The only potential benefit of the wall is to block the flow of shallow DNAPL to the river." As stated in our General Comments, properly integrated into hydraulic control/containment SCM, the vertical barrier will enhance DNAPL control/containment by increasing horizontal and upward vertical gradients behind the structure and also provide some measure of reduced river water influx.

**Section 11.1.** DEQ concurs with NW Natural's plan to perform periodic inspections of the extraction wells. Based on DEQ's experience with pump and treat systems, it is likely scheduled maintenance of the wells and treatment system components will be needed to maintain operational efficiency and performance. NW Natural should evaluate the effect maintenance shut-downs will have on controlling and containing DNAPL and/or contaminated groundwater (e.g., break-through or bypass during maintenance periods).

**Section 11.2.** DEQ's General Comment regarding chemical measures and performance monitoring applies here.

**Tables 2 and 5a.** The effectiveness of "Physical Barriers" should be listed as "H" in Table 2, especially since in this document effectiveness also encompasses long-term reliability and implementation risk. It is not clear why monitored natural attenuation (MNA) is listed under "In Situ Biological Treatment" as it also appears in its own category at the end of the table.

For Segment 1 (Table 5a), it is not clear that effectiveness and reliability are independent of the barrier wall length and depth; see comments on Sections 3.3.4 and 6.2.2. These factors should be considered independent of cost and implementability factors (all balancing factors should be evaluated independent of other factors). This comment should be considered during preparation of the FS.

In general, DEQ had many questions regarding NW Natural's approach to SCMs alternatives scoring. These questions are not raised in this letter as DEQ concurred with NW Natural's general SCMs alternatives recommendations for segments 1 and 2. This topic will need to be discussed further prior to initiating the upland FS.

**Figure 2, Figures 5-E1 through 5-E5, and Figure 6a.** Groundwater analytical data and DNAPL observations from the MW-16 and MW-18 monitoring well clusters are used in each of these figures. There appears to be a discrepancy regarding the thickness of DNAPL depicted by Figure 2 and figures 5-E1 through 5-E5 and Figure 6a. Figure 2 indicates that approximately 45 feet of DNAPL was observed, whereas figures 5-E1 through 5-E5 and Figure 6a indicate roughly 20 feet. For completeness the figures should depict DNAPL occurring in the fill unit and the alluvium. The figures should be reviewed and revised as appropriate.

**Figure 2, Figure 3, Figure 13, and Figure 14.** These figures depict interpretations of subsurface geology along a nearshore transect (Figure 3) and along the top of the riverbank (figures 3, 13, and 14). Depending on boring location, the geology of the alluvial WBZ is shown as being predominantly "Sand to Sandy Silt" and "Silt to Sandy Silt" in varying proportions. DEQ recommends that NW Natural review these figures and revise them based on grain-size analyses. The figures as drawn do not illustrate the lateral and vertical distribution of the dominant material types noted in Section 3.2.1.1.1 (e.g., fine sand, medium sand). Revising the figures using grain-size analyses, would better represent the hydrostratigraphy of the alluvial WBZ. Additionally, from DEQ's understanding of the labeling scheme, it appears that the "Sand to Sandy Silt" label should be changed to "Sand to Silty Sand." Revisions to these figures should be included in the draft SCMs design report.

**Figures 5-E1 through 5-E5 and 6a.** These figures depict the vertical distribution of dissolved constituent concentrations and DNAPL along a subsurface profile extending from the uplands through the TBRA. The offshore projection of the profile extends between borings GS-06 and GS-07. Given its location, boring GS-07 should have been shown on the profile to present more representative data and observations of subsurface

contamination occurring in this portion of the Gasco Site. Boring GS-07 should replace GS-06 on these figures for future submittals.

**Figures 5-F1 through 5-F5.** According to these figures DNAPL was not measured during the Targost® logging work completed at boring TG-8. However, the data log provided in Appendix G shows that over 24 feet of DNAPL was measured at that boring location. The referenced figures should be revised for future documents.

**Figures 6a and 6b.** In many sections of the Groundwater/DNAPL FFS the depth of occurrence of DNAPL is discussed in terms of the bottom of the river channel. For completeness, these figures should be revised by projecting the interpreted upper sediment surface out to the navigation channel. In addition, a profile through TG-08 (revised per the comment above), the PW-04 extraction well pair, the MW05 monitoring well cluster, MW20-120, and GP-09 should be added to this group of figures for the draft SCMs design report.

**Figure 8.** It is not clear to DEQ whether the extraction well system capture zone reflects the presence of a vertical barrier or not, and whether the capture zones are is representative of steady-state or transient conditions. The different lengths of particle tracks suggest the figure shows the extent of capture at multiple times. If the figure depicts transient conditions, the development of capture zones with the corresponding time(s) since pumping started should be provided on the figure.

**Appendix A.** Monitoring well WS21-112 is missing from figures A-01 through A-41. These figures should be reviewed and revised for future submittals.

**Appendix E.** Boring logs and/or construction information for extraction wells PW04-85 and PW04-118 are not provided in the appendix. Additionally, the data and analysis of the PW04-85 and PW04-118 performance tests appear to be incomplete. According to the Pilot Program Report[13] approved by DEQ, ten monitoring wells were selected for use as observation wells during the performance tests (see Table 5, Pilot Program Report). Although post-pumping hydrographs are presented for these wells (Figure 2-1, Appendix E), only five wells are used to analyze the actual performance tests. Water level data and data analysis from the only fill WBZ installation (MW05-32), two of the new monitoring wells installed to monitor the tests (MW19-125, MW19-180), and the nearest Siltronic monitoring wells (WS14-125, WS14-160) to the PW04 pair are not included. Assessing the influence of pumping the wells on water levels in the fill WBZ, and the results of time-series groundwater sampling are also not discussed.

Lastly, DEQ requests the figures 4-3 and 4-4 be revised to show the input parameters used for the model. This information is necessary to evaluate how the hydraulic properties of the alluvial WBZ were used to construct the model.

NW Natural should provide the information and data described above in the "pilot well report" being prepared.

## NEXT STEPS

DEQ is not requiring the Groundwater/DNAPL FFS to be revised and resubmitted at this time. DEQ will require that NW Natural confirm in writing that the conditions and comments included in this letter will be

[13] Anchor Environmental, LLC, 2007, "Groundwater/NAPL Pilot Program, Extraction Well and Performance Evaluation Design Report," May (amended July 5, 2007), a report prepared for NW Natural.

addressed in the draft SCMs design document. The cover letter to the draft design document should clearly indicate how DEQ's conditions and comments have been incorporated into the submittal. In addition, prior to initiating work on the draft design document, NW Natural should fully respond to DEQ's General Comment regarding the preliminary groundwater model and update the overall schedule for SCMs planning, design, and implementation, and the upland RI/FS.

DEQ appreciates and acknowledges the significant amount of work NW Natural has conducted this passed year to support the Groundwater/DNAPL FFS for shoreline segments 1 and 2, including: 1) further evaluating the vertical and horizontal extent of groundwater contamination and DNAPL, 2) assessing the relationship between uplands groundwater impacts, and groundwater and TZW contamination beneath the river; and 3) collecting sediment and surface water data in the Willamette River. The work has identified a source control strategy for mitigating contamination migrating to the river along the shoreline of the NW Natural Property and the northern portion of the Siltronic Property, including the most heavily impacted shoreline segment.

Please call me at (503) 229-5543 if you have questions regarding this letter.

Sincerely,

Dana Bayuk, Project Manager
NWR Cleanup Section

Attachment: EPA February 8, 2008 letter
Stratus December 19, 2007 memorandum

Cc: Sandy Hart, NW Natural
Patty Dost, Schwabe Williamson & Wyatt
Tom McCue, Siltronic
Alan Gladstone, Davis Rothwell Earle & Xochihua, P.C.
John Edwards, Anchor Environmental, LLC
Carl Stivers, Anchor Environmental, LLC
Rob Ede, Hahn and Associates, Inc.
James Peale, MFA
Ted Wall, MFA
Eric Bakkom, MFA
Jennifer Peers, Stratus Consulting, Inc.
Eric Blischke, EPA
Rene Fuentes, EPA
Chip Humphries, EPA
Kristine Koch, EPA
Sean Sheldrake, EPA
Cyril Young, DSL
Jim Anderson, DEQ/PHS
Tom Gainer, DEQ/PHS
Henning Larsen, DEQ/SRS
Matt McClincy, DEQ/PHS
ECSI file nos. 84 and 183

# Memorandum

**To:** Jim Anderson, Oregon Department of Environmental Quality

**cc:** Michael Karnosh, Confederated Tribes of Grand Ronde
Lisa Bluelake, Confederated Tribes of Grand Ronde
Erin Madden, Cascadia Law PC
Thomas Downey, Department of Natural Resources (Siletz)
William Barquin, Haglund Kelley Horngren Jones & Wilder LLP
Audie Huber, Department of Natural Resources, Confederated Tribes of the Umatilla Indian Reservation
J.D. Williams, Law Office of J.D. Williams
Brian Cunninghame, Confederated Tribes of Warm Springs

**From:** Jennifer Peers, Stratus Consulting Inc.

**Date:** 12/19/2007

**Subject:** Comments on Gasco Draft FFS Reports

This memorandum contains comments provided by Stratus Consulting on behalf of the Confederated Tribes of The Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon. Thank you for considering these comments.

The following comments pertain to the Groundwater/DNAPL Source Control Focused Feasibility Study: NW Natural "Gasco" Site, prepared by Anchor Environmental, L.L.C. in November 2007 (NW Natural FFS) and the Focused Feasibility Study: Siltronic Corporation prepared by Maul Foster & Alongi, Inc. on October 22, 2007 (Siltronic FFS).

Please note that Stratus Consulting is providing these comments after a rapid review of these two documents in isolation; we have not had an opportunity to review the underlying data or the Remedial Investigation (RI) reports. We first present some overall observations and comments, and then some more specific comments for each document.

**Overall comments**

These Feasibility Studies are for interim actions that are part of a short timeline. In the NW Natural FFS, it is noted that the Remedial Investigation and the Risk Assessment have not yet been approved by DEQ. In both reports, the results of several studies are presented that have not been validated or reviewed, but are nonetheless relied upon. This is a concern, and we recommend that all data and supporting reports and studies be thoroughly evaluated by qualified engineers prior to selection of a remedy.

Another important concern is that the two reports are inconsistent in their understanding of the site conceptual model and the fate and transport mechanisms at the site. For example, the NW Natural FFS determines that enhanced in-situ bioremediation treatments are likely to be unsuccessful because of the heterogeneity of the subsurface and presence of interbedded silt lenses (p. 47) yet the Siltronic FSS has chosen enhanced in-situ bioremediation as their preferred remedial alternative and claim to have successfully demonstrated its efficacy in their enhanced in-situ bioremediation pilot study (Section 1.3 in the Siltronic FSS). Further, the selected alternatives need to be considered together because of the potential effects on each other. The authors of the Siltronic FFS suggest that the selected remedy in the NW Natural FFS will negatively impact the success of their selected remedy but do not attempt to adapt their selected remedy to account for this. Additional coordination is clearly necessary.

Finally, both reports seem to be stressing the need for rapid decision-making. The Siltronic FFS even suggests that a public comment period be waived. Although rapid cleanup is desirable, if selection of a remedy is not appropriately evaluated the risk of failure increases. Public involvement at this site in the context of the overall Portland Harbor cleanup is particularly important.

**Specific Comments on NW Natural FFS**

The NW Natural FFS evaluates the alternatives based on physical goals because there are no "numeric guidelines or points of compliance specific to source controls" (p. 30). Although this may be true, long term monitoring performance criteria should include some evaluation of chemical concentrations. "Supporting Chemical Guidelines" are presented in Section 4.2.2 (p. 32) of the NW Natural FSS; however a clearer definition of the chemical action levels at this site and a more thorough examination of the applicable or relevant and appropriate requirements (ARARs) should be incorporated into the NW Natural FSS. For example, the ambiguity presented in the second paragraph, first line, of Section 4.2.2 (p. 32) relative to meeting chemical screening levels should be clarified.

The delineation of DNAPL in the figures in Appendix G is only for "potentially mobile" DNAPL. Other areas of DNAPL at the site discussed in the text may represent ongoing sources of contamination of concern to DEQ. These areas are not depicted in these figures and were not surveyed with the TarGOST survey method. This represents a potential data gap.

On pages 41-42, the report's authors state that groundwater pumping-induced gradient reversals and "gravitational forces" will prevent DNAPL located deeper than the river bottom from migrating to and upward into the river channel. This later becomes part of the justification for a physical barrier only down to the river depth. Our experience at other manufactured gas plant (MGP) sites with similar DNAPL materials indicates that this assumption is not a reasonable one. MGP DNAPLs (e.g. coal tar), although more dense than water, can migrate against gravity and hydraulic gradients (U.S. EPA 2006; U.S. EPA 1991). It is possible that the wall, in

combination with the pump and treat system, would be effective, but this assumption is unsettling. A thorough evaluation of the RI data and other information on groundwater flow and DNAPL migration should be conducted by a qualified engineer before assuming that DNAPL would not migrate vertically or continue to migrate beneath the containment wall into the river bed.

The NW Natural FFS indicates that a monitoring program will be designed as a part of source control design (p. 63). This is an important element of any selected remedy and particularly ones that involve pump and treat systems. It would be good to elaborate more in the FFS.

We agree with the proposed seepage meter study in Section 3.3.1 of the NW Natural FSS and believe that these data should be evaluated prior to selection of a site remedy at both the NW Natural and the Siltronic sites.

The NW Natural FFS does not describe how treated water from the pump and treat system will be disposed, nor what water quality standards it must meet. The system will be designed to remove all petroleum derived contaminants of interest and free cyanide to below 10 µg/L (p. 64), but does not discuss total cyanide, nor how the design effectiveness will be evaluated.

**Specific Comments on Siltronic FFS**

The Siltronic FFS only presents one type of technology as a remedial alternative (in addition to no-action and monitored natural attenuation) rather that a full suite of alternatives as presented in the NW Natural FFS. The Siltronic FFS only compares various configurations of an enhanced in-situ bioremediation program. Other types of technologies, in particular a pump and treat system similar to that selected as a component of the selected alternative in the NW Natural FFS, would also be appropriate and should be considered.

A fundamental concern with the chosen remedial alternative presented in the Siltronic FSS is the potential risk associated with failure. The authors indicate that a successful pilot-scale study supports the effectiveness of enhanced in-situ bioremediation (EIB). However, there are always differences between small-scale pilot studies and a full remedy. The scale, methods and results of the pilot study should be thoroughly reviewed by a qualified engineer before approval.

The reductive dechlorination pathway (biodegradation) cited by the authors (Section 1.3, p. 1-3) progresses as follows: trichloroethene (TCE) degrades to dichloroethene (DCE) isomers, which degrade to vinyl chloride (VC), and finally to the non-toxic degradation daughter product ethene (U.S. EPA 1998). The produced VC is more toxic than either TCE or DCE. In aerobic conditions, VC is rapidly degraded, but under reducing conditions VC is degraded more slowly than TCE and tends to accumulate (U.S. EPA 1998; Freedman and Gossett 1998). If the degradation enhancement products fail to completely interact with the VC-producing areas of the plume, this degradation process could stall and VC could accumulate and eventually be

transported to the river. This type of failure may result from an incomplete or inaccurate site conceptual model, changes in aquifer flow patterns induced by artificial pumping, mineral deposition within the aquifer matrix, or physical barriers to groundwater flow. In short, the potential for the selected remedy to fail to prevent releases of hazardous substances exists and the risks should be thoroughly evaluated in comparison to other technologies (which was not done in the Siltronic FFS). We recommend that all of the supporting documentation for this remedy be thoroughly examined by a qualified engineer with experience in the application and evaluation of this technology.

Hydraulic conductivity at the site is estimated based on slug testing, rather than pump tests (Section 1.4.2). Slug tests generally are less reliable and often result in lower estimates of hydraulic conductivity than pump tests. This could affect the accuracy of the conceptual site model and remedial design, and a pump test may be warranted.

In Section 2.2.3.1 (p. 2-4) the authors note that the injection of EHC, a carbon/iron mixture, will not increase the residual iron in the aquifer. This claim should be supported since the authors note that the aquifer already has high concentrations of iron (p. 2-6) and that high iron concentrations could "represent an impediment to operation of a groundwater-extraction system," which is presented as a preferred remedial alternative in the NW Natural FSS. Again, this points out the need for better coordination between the remedies at the two sites.

The term "fatal flaw" is used on three occasions (pp. 2-5, 3-8,4-3) by the authors throughout the FSS to describe potential problems identified (but sometimes undefined) through their analysis. Although not a technical comment, this sort of language should be eliminated from the document as it has the potential to create misunderstanding regarding the gravity of the concerns raised by the authors.

## Citations

U.S. EPA. 1991. Ground Water Issue: Dense Nonaqueous Phase Liquids. U.S. Environmental Protection Agency. EPA/540/4-91-002.

U.S. EPA. 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water,* U.S. Environmental Protection Agency. EPA/600/R-98/128, September.

U.S. EPA. 2006. Innovations in Site Characterization Case Study: The Role of a Conceptual Site Model for Expedited Site Characterization Using the Triad Approach at the Poudre River Site, Fort Collins, Colorado. Available at: http://www.clu-n.org/download/char/poudre_river_case_study.pdf

Freedman, D. and J. Gossett. 1989. Biological Reductive Dechlorination of Tetrachoroethylene and Trichloroethylene to Ethylene under Methanogenic Conditions, *Applied and Environmental Microbiology*, September, Vol 55. No 9.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

February 8, 2008

Reply To: ECL-115

Mr. James M. Anderson
DEQ Northwest Region
Portland Harbor Section
2020 SW Fourth Ave, Suite 400
Portland, OR 97201

RE: GASCO Groundwater/DNAPL Source Control Focused Feasibility Study, November 2007

Dear Mr. Anderson:

EPA has reviewed the above referenced Focused Feasibility Study (FFS) for the Gasco Site for consistency with the long-term cleanup of Portland Harbor and consistency with other work being performed within the Portland Harbor Superfund site. EPA is pleased that this site has moved closer toward evaluating source control technologies and constructing controls for the ongoing discharges to the Willamette River. Based on the information provided in this document, EPA provides the following comments for DEQ to consider in proceeding forward with its decisions regarding upland source control at this site.

1. The FFS does not consider all typical, effective, and feasible options for source control for Manufactured Gas Plant (MGP) sites. The stated objectives for source control at GASCO is to contain the NAPL so it does not continue to move beyond site boundaries into and under the river and contain dissolved phase plumes also leaving the site. However, hot spot/source area removal or treatment is not considered or analyzed to assure long-term effectiveness of the containment technologies. Removal of heavily impacted soils, to the extent technically feasible, should be evaluated as part of the final remedy for source control. The evaluation should include excavation, handling and treatment/disposal needs as components of the removal option.

   While the FFS does discuss remediation options for NAPL contaminated areas, it dismisses each of those as not feasible (see Table 2 and Section 6.6 of report). EPA sees two major problems with that section: 1) it does not seem to attempt to deal with soil/NAPL removal by excavation in the upper zones, where a large amount of the contamination is present; and 2) many of the technologies are discarded because of the combined PAH and cyanide incompatibility in treatment trains. Since it seems the highly concentrated areas of cyanide (much of it near the north end of the site) are not highly contaminated with PAHs and the major PAH contamination sources in the "mobile NAPL" (areas

where TarGost was used) are not as highly contaminated with cyanide, it seems reasonable to attempt to separate the remediation technologies by areas before reaching conclusions that nothing can be done at the site except pump and treat near the shoreline. The logic that appears from this presentation is that there is no single technology that can work for dissolved, NAPL, and soils, especially where the contaminants include both PAHs and cyanide. EPA suggests that what is necessary to begin the process of remediation is to separate the site into areas, contaminant types, media of concern, and dissolved or NAPL. Then the use of sequential treatment methods can be adapted to the site.

The concept presented in this draft Focused Feasibility Study (FFS) is that using only limited hydraulic control of dissolved contaminants is sufficient to control sources to the Willamette River. While it may provide short-term controls necessary for EPA to conduct in-water removal actions, it would, at the very least, make it difficult for EPA to conduct in-water remedial actions. The FFS presents a picture of source material NAPL moving laterally toward the river as well as some of it sinking deeper. Likewise, groundwater moving through and around the source material NAPL dissolves constituents which move more quickly off site with groundwater flux. Early removal of the source material will decrease the mass of material subjected to continual dissolution. Additionally, source material removal will decrease the amount of NAPL that will continue over time to travel to the river. The basic technologies evaluated in the FFS, e.g., a wall to contain the NAPL and hydrologic control to contain the dissolved phase, will be more effective in the long-term if source material is removed.

EPA considers the source material at this site to be all areas delineated in the TarGost data presentation (appendix G, Figure G1). The source material present at the site should be removed to the extent possible, which may require work plans in the scale of mining, highway soil excavation and removal, or subsurface building construction projects, rather than on the scale of a small scale leak of dissolved material which can be controlled or remediated using pump and treat systems. As presented, even assuming that there are sufficient wells to contain the discharge, the system will only contain some of the dissolved contamination as long as the pumping remains functional, and never have any impact on the sources which are the cause of the dissolved plumes. For Source Control, such a system would not be acceptable due to its built-in, long-term inefficiency, where the source is never cleaned in spite of all the expenditures of funds and the energy wasted. In addition, an active hydraulic control system without source removal requires continuous vigilance and monitoring with very little margin for errors or equipment failures.

The barrier wall proposed is very limited in depth and lateral extent, and should also be extended to be a more fully enclosing system, which would prevent any water from continually entering the DNAPL source zones and becoming contaminated. A final source control action should ensure, at a minimum, that the sources are enclosed by a barrier wall and then the source excavated to remove as

much of the source material as possible. Once that is accomplished the hydraulic pump and treat systems, as well as potentially some level of monitored natural attenuation may be able to keep contaminant plumes from re-developing and reaching the river again. Additionally, it is preferable that the hydraulic pump and Treat systems be located further upland to allow for monitoring wells to be installed to ensure that the groundwater plume and NAPL are "controlled" prior to reaching the river.

A final source control action should include a more detailed presentation of source removal technologies, including deep soil removal inside of rigid containment structures (with dewatering as needed to allow work to depth), oil field type extraction techniques once the area is contained to avoid discharges to aquifer, including recharging extracted water to mobilize the source material, and thermal extraction. Source removal should be reconsidered for this source control action.

2. NAPL removal (both light and dense), should be evaluated in the FFS. The evaluation should also consider measures to limit the mobility by control, containment, or in-situ treatment where NAPL removal is not technically feasible.

   The FFS has a mixed discussion of controlling NAPL and dissolved contaminants, and the model is meant to control dissolved contaminants, not NAPL. It is not clear that any of the pumping would help to control DNAPL movement. One specific concern is that a change in hydraulic conductivity can easily change by an order of magnitude depending where on the site the aquifer tests were done, which may make the stated extraction rates presented (12 to 20 gpm) increase substantially. Without that level of detail it is not possible to determine whether the proposed pumping rates are even in the correct range. While some of the interpretation is presented in Appendix E, there should be more discussion of the overall estimate of uncertainty.

   Another concern is that the information presented in the Appendix E indicates that there are multiple assumptions that had to be made to do the calculations due to: the limited depths and screening of the pumping wells; the location of the wells near the river; and the much higher hydraulic conductivity near the river and at depth in the aquifer. Regardless, the issue is that the results of the model should be used only for general planning and design purposes, and the final acceptance should be based on well-defined criteria for hydraulic containment of both NAPL and dissolved contaminants, based on capture zone analysis, and on monitoring that will meet the criteria for capture zone monitoring requirements. Note that there should be contingencies for variability in the river stage, and that the modeling and actual capture need to account for worst case conditions (high precipitation, low river stage, post flood events, etc.), not just an average.

3. The FFS does include much data of high quality, especially the new TarGost data, which does help to delineate the vertical presence of NAPL very well,

characterize the source areas and delineate where the work should be concentrated. However, the report only has data for the areas closer to the river, which may not cover all the important source area. Further, there is a gap between the data available, the high concentrations and large areas (and volumes of contaminants), and the proposed remedial actions. It is this discrepancy between the contamination extent and the proposed solution that presents the major problem with this plan. There is limited discussion on what would control the movement of the NAPL, or how the proposal will not remediate the contamination sources at the site. The areas beyond the presently delineated zones need to be considered in a final source control determination for enclosure by other barrier walls if those areas will not be removed. This should also be included, at least in concept, in the next version of the FFS.

4. The document should include detailed conceptual descriptions and references to key topics related to hydraulic containment, such as "Capture Zone", which refers to the three-dimensional region in an aquifer that contributes the water that is extracted by pumping from one or more wells or drains. Similarly, any final source control action should include sections which propose conducting a long-term monitoring optimization (LTMO) of the site and proposed pumping systems, and considerations related to Cost Effective Design for Pump & Treat Systems EPA 542-R-05-008, April 2005.

5. The modeling provided in Appendix E has a reasonable level of discussion, and a significant amount of analysis to interpret the pump test data and to support the results; however, there are many limitations to the usefulness of the pumping which are not highlighted in the main text. Below are some quotes from Appendix E that illustrate these limitations -

> "It is also worth noting in Figure 3-2 that the water level at MW-4-57 is very close to the river stage. This indicates that there is a strong connection between the river and the aquifer, which is also evident in the tidal response. This suggests that contact between the river and the aquifer is through higher K sandy material and that nearshore silt or silt lenses in the aquifer do not significantly affect the connection between the river and the aquifer. If silty sediments affected the connection between the river and the aquifer, there would be a greater water level drop between the aquifer and the river." (Page 20 Appendix E)

> "The capture zone analysis was also used to evaluate the depth of capture. One of the objectives of the modeling analysis was to determine the pump rate necessary to capture to approximately 130 feet bgs based on the vertical extent of contamination in the aquifer. The capture zone analysis showed that a pump rate of 20 gpm per well was sufficient to capture the full vertical extent of the aquifer and that fine tuning the pump rate to only capture to a specific vertical zone was not practical. This is due to the tendency for breakthrough to occur horizontally around the edges of the

wellfield even though the capture zone extends to the base of the aquifer in the center of the wellfield." (Page 27 Appendix E)

"A groundwater flow model has been developed to evaluate groundwater flow in greater detail and to provide a tool for evaluation of Feasibility Study (FS) alternatives. The modeling approach has been presented to DEQ, so only an overview of the model setup and calibration is presented here." (Page 20 Appendix E)

6. Residual contamination should be evaluated for the feasibility of in-situ treatment or containment for any groundwater source control action. Groundwater controls should be prioritized to first remove and/or treat the plume and lastly contain the plume. Natural attenuation should only be considered if the source area is removed, contained or treated. EPA supports a proposal for a pump and treat system, in conjunction with source removal, and as a continued system after that removal. However, the pump and treat system needs to incorporate detailed elements to document a capture zone for the entire system (note that EPA has a draft document on what is expected for capture zone documentation). That level of detail is not even proposed in this FFS. While this would not be expected to be covered in detail in this document, it should be included as one of those key items which will verify that the hydraulic containment is working as planned, and if not the system can be altered (increasing pumping rates or adding extraction wells) as needed. The revised FFS proposal needs to have this level of commitment and level of detail included.

7. Where a significant source of contamination to the Willamette River exists at a site, the evaluation of cleanup alternatives should include a preference for controls that remove and/or treats the source material. The beneficial uses of the Willamette River are the future uses that source control actions need to consider. As a point of comparison, it should be noted that the New York State Department of Environmental Conservation has identified 194 MGP in the state, and has Records of Decision (ROD) for all but 27 of them. Most of those RODs include soil and / NAPL excavation and removal as part of the remedial work. That information can be reviewed in more detail at the following links:

   http://www.dec.ny.gov/chemical/24913.html
   http://www.dec.ny.gov/docs/remediation_hudson_pdf/mgp_strat.pdf

8. When a revised FFS is presented it should include a discussion of the main remedial objectives and how any proposal will accomplish that objective. In this FFS there are a mixture of objectives and proposed actions, which do not seem to be fully developed to show that each proposal (a barrier wall to a given depth, or a pump and treat system, or both) will meet the necessary objectives for the site for both the short term and the long term. Of major concern is that the FFS does not include points of compliance or specific chemical performance standards for the action to achieve; guidelines do not constitute performance standards. While key factors, such as hydraulic conductivity parameters and related calculations were

measured, estimated and calculated, and interpreted in multiple manners, the levels of uncertainty for the effectiveness of the calculated pumping rates and how those relate to the objectives is not clear.

The draft FFS does not propose concepts and options that will make this site either controlled or stable in the short and long terms. The revised version should present a proposal that is based on a combination of individual, but coordinated approaches (removals, containment of NAPL, treatment trains, etc.) which will provide containment and remediation which is effective in both the short and the long term coupled with a monitoring scheme to show effectiveness of the control. What has been presented in this report is not sufficient for containment and does not include any type of permanent remedial technologies to decrease permanently the contamination sources at the site.

If you have any questions or would like to discuss the contents of this letter further, please feel free to contact me at (206) 553-7216.

Sincerely,

Deb Yamamoto

Deb Yamamoto, Unit Manager
Site Cleanup Unit #2
Office of Environmental Cleanup

cc: Sean Sheldrake, EPA-ECL
Chip Humphrey, EPA-OOO
Dana Bayuk, ODEQ-NW
Eric Blischke, EPA-OOO
Kristine Koch, EPA-ECL
Lori Cora, EPA-ORC
Rene Fuentes, EPA-OEA

NWN/204
Witness: Robert Wyatt

# BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

## UG 263

## NW NATURAL

**Exhibit Accompanying Direct Testimony of Robert Wyatt**

**Letter Dated August 22, 2008, from DEQ**

**October 2013**

Oregon
Theodore Kulongoski, Governor

**Department of Environmental Quality**
**Northwest Region Portland Office**
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987
(503) 229-5263
FAX (503) 229-6945
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August 22, 2008

*Also Sent Via E-mail*

Mr. Robert J. Wyatt
Northwest Natural Gas Company
220 N.W. Second Avenue
Portland, OR 97209

**Re: Preliminary Design Report**
**Shoreline Segments 1 and 2, NW Natural Property and the Northern Portion of the Siltronic Corporation Property**
**Portland, Oregon**
**ECSI No. 84**

Dear Mr. Wyatt:

The Department of Environmental Quality (DEQ) reviewed the "Preliminary Design Report – Groundwater Source Control, NW Natural Gasco Site" dated June 2008 (Preliminary Design Report). Anchor Environmental, LLC (Anchor) prepared the Preliminary Design Report on behalf of NW Natural. The Preliminary Design Report summarizes the current status of groundwater and riverbank removal action (i.e., source control measures) planning and design.

## BACKGROUND

DEQ has determined the shoreline of the property owned by NW Natural (NW Natural Property, or Gasco Site) and the northern portion of the Siltronic-owned property (Siltronic Property) are high priorities for source control. The portion of the shoreline identified as the highest priority for source control (Segment 1) extends from downstream of the "Tar Body Removal Area" [1] (TBRA) on the NW Natural Property, to upstream of the former Gasco manufactured gas plant (MGP) effluent overflow ponds on the Siltronic Property. This segment coincides with the heaviest MGP-related impacts identified near the river, including dense non-aqueous phase liquids (DNAPLs), impacted riverbank soils, and contaminated groundwater. It also includes the portion of the Siltronic Property where groundwater contamination caused by Siltronic has commingled with DNAPLs and groundwater contamination resulting from former Gasco MGP operations. The segment of NW Natural's shoreline between the TBRA and NW Natural's downstream property line with US Moorings (Segment 2) is considered a high priority for source control, primarily due to the presence and concentrations of MGP chemicals of interest (COI), particularly cyanide, in riverbank soils and groundwater. A third shoreline segment (Segment 3) extends from upstream of the former effluent ponds to the upstream Siltronic Property line. A source control evaluation of Segment 3 is ongoing and is projected for completion before the end of the year.

[1] The "Tar Body Removal Area" and former effluent ponds are features associated with the historic operation of the former Gasco MGP. The TBRA was subject to an EPA early action conducted in the late-summer/early-fall 2005.

NW Natural completed the Groundwater/DNAPL FFS in November 2007[2]. The Groundwater/DNAPL FFS presented NW Natural's evaluation of source control measures (SCMs) alternatives to mitigate migration of groundwater contamination and the movement of DNAPLs to the Willamette River and its sediments. DEQ approved NW Natural's recommended SCMs alternative that combined a hydraulic control/containment system along the shoreline of the NW Natural Property and the northern portion of the Siltronic Property, with a vertical barrier in the southern portion of the NW Natural Property. DEQ's approval was subject to the conditions and comments detailed in a March 21, 2008 letter (March 21st Letter) regarding the Groundwater/DNAPL FFS.

As noted in the Preliminary Design Report, NW Natural and DEQ participated in a series of meetings to work through the more substantive issues identified in the March 21st Letter. The meetings were intended to streamline the SCMs planning and design process. The Preliminary Design Report is supposed to: 1) reflect the status of SCMs planning and design based on the outcomes of the meetings; and 2) provide the basis for moving forward into design. The initial design document (i.e., the "Interim Design Report") will include the findings and results of ongoing (groundwater treatability study) and future studies (vibration study, DNAPL movement/mobility evaluation, DNAPL removal pilot study), being conducted to support SCMs design.

DEQ comments regarding the Preliminary Design Report are provided below and are intended to clarify DEQ's understanding of the agreements reached during planning meetings, and our position on certain aspects of the SCMs planning and design process.

## GENERAL COMMENTS

### DNAPL Movement and Mobility Evaluation

DEQ made it clear in numerous meetings and correspondence that evaluations of the nature and extent of DNAPL and DNAPL mobility are needed to finalize the location, alignment, and dimensions of the vertical barrier. The DNAPL evaluation would also support planning and design of other source control measures, including assessing the influence of hydraulic control/containment on DNAPL movement, and developing DNAPL removal schemes. In the March 21st Letter and in follow-up meetings, DEQ provides guidance on methods NW Natural could use to evaluate DNAPL movement/mobility. Furthermore, in letters dated July 12, and August 29, 2006, NW Natural recommends approaches for assessing DNAPL mobility and containment under conditions of changing hydraulic gradients, which are, in part, information items identified by DEQ for the DNAPL movement/mobility evaluation.

To date, NW Natural has not attempted to carry out the DNAPL evaluations. Section 3.3 of the Preliminary Design Report indicates that with regard to evaluating whether the vertical barrier will prevent DNAPL from migrating beyond the wall to the river, "Unfortunately, NW Natural is not aware

[2] Anchor Environmental, LLC, 2007, "Groundwater/DNAPL Source Control Focused Feasibility Study – NW Natural 'Gasco' Site," October 12 (amended November 9th), and report prepared for NW Natural.

of any reliable, proven method to make such a demonstration of DNAPL behavior under similar circumstances."

DEQ continues to consider DNAPL movement/mobility important for establishing basic design parameters of the vertical barrier, particularly the depth. Absent an evaluation of DNAPL nature, extent, and movement under ambient and SCMs operating conditions DEQ cannot approve the vertical barrier depicted in Figure 4 of the Preliminary Design Report.

Given the lack of progress to date and lacking a commitment by NW Natural, DEQ will perform a DNAPL evaluation with the specific objective of assessing the depth of the vertical barrier proposed in the Preliminary Design Report (i.e., between -50 and -60 feet mean sea level [msl]). NW Natural should be advised the DNAPL evaluation could indicate the proposed depth of the vertical barrier is insufficient. If this is the case, NW Natural may have to conduct additional vibration testing with equipment able to achieve greater vertical barrier construction depths.

For clarification, DEQ continues to expect NW Natural to conduct an evaluation of DNAPL movement/mobility to support the hydraulic control/containment and DNAPL removal systems planning and design process. This DNAPL movement/mobility evaluation referenced in this paragraph is separate from, and broader in scope than the evaluation described above that focuses on assessing the depth of the vertical barrier. DEQ will consider hydraulic containment system and DNAPL removal planning and design incomplete without such an evaluation.

Within 14 days receipt of this letter, NW Natural should indicate their commitment to perform the DNAPL movement/mobility evaluation by submitting an outline of the approach. Absent a commitment from NW Natural to perform the evaluation DEQ will conduct the work.

**DNAPL Removal Pilot Testing**

NW Natural proposes to conduct DNAPL removal pilot tests at two locations (Targost® borings TG-8 and TG-13), using vertical wells designed for this purpose. As proposed the wells will be screened over the entire thickness of DNAPL identified from Targost® logs (i.e., from just above the base of the fill unit, through the silt unit, and into the upper-most alluvium). DEQ understands pilot testing will be conducted to assess the influence of gradient changes on DNAPL movement. DNAPL movement will be inferred based on the measured differences between DNAPL accumulation in the pilot wells under non-pumping and pumping conditions. DEQ further understands NW Natural will use this information to: 1) interpret whether operation of the hydraulic control/containment system could increase DNAPL movement beneath the ponds, and 2) assist in the design of the numbers and types of wells that will be constructed in the former effluent pond areas.

The data collection objectives of the pilot tests are too narrow for purposes of developing an approach to remove DNAPL from beneath the former effluent ponds (i.e., reduce DNAPL "head" beneath the ponds). More specifically, the pilot test should assess the occurrence of DNAPL at the base of the fill that could be feeding DNAPL migrating vertically downward through the silt and into the alluvium. Absent DNAPLs controls in the fill water-bearing zone (WBZ), constructing and operating extraction

wells through and/or below the silt unit has the potential for increasing downward vertical migration of DNAPL. Additionally, there is insufficient information provided in the Preliminary Design Report regarding how the pilot tests will achieve the two data collection objectives listed above. For example, discussions of how the data collected during the pilot tests will be used to assess DNAPL removal alternatives (e.g., trenches, vertical wells, horizontal wells); or estimate design parameters for DNAPL removal (e.g., radius of extraction well influence, the density, numbers, and locations of DNAPL recovery wells) should be provided. The pilot study should also discuss how installation of the pilot wells could influence interpretations of DNAPL accumulation rates.

Planning for DNAPL removal in the former effluent pond areas is in the early stages. Based on our initial review of the Preliminary Design Report, DEQ approved the locations of the pilot tests and requested NW Natural to revise the scope of work by developing more detailed plans for drilling and installing the vertical pilot DNAPL recovery wells. Drilling and installation methods should consider the stratigraphy of the fill and alluvial units and further assess the occurrence of DNAPL at the base of the fill. Preparation of the revised plan is ongoing.

DEQ expects NW Natural to include two phases in the pilot test to assess: 1) the occurrence of DNAPL in the fill unit, and DNAPL removal from the base of the fill WBZ, and 2) DNAPL removal from the upper alluvial WBZ (Targost® logs provide information regarding the occurrence of DNAPL in the upper alluvial WBZ). Prior to conducting pilot tests, DEQ expects the data collection objectives to be refined by evaluating DNAPL nature, extent, and volume beneath the former effluent ponds by compiling Targost® logging data onto geologic cross-sections. Cross-sections should be prepared throughout the footprint(s) of the former effluent pond areas on both the NW Natural and Siltronic properties.

**Sequencing Source Control Measures**

The Preliminary Design Report describes the status of ongoing planning for each principal element of the source control project. The document also provides a schedule for the overall source control project that anticipates SCMs construction occurring between June and November 2009. The major elements of source control (vertical barrier, hydraulic control/containment, and DNAPL removal) are intended to operate as integrated elements. In other words each element will be designed to enhance the effectiveness of the other measure(s). Planned sequencing of SCMs implementation can further increase effectiveness. The Interim Design Report should present NW Natural's plan for sequencing implementation of integrated SCMs. For example, DNAPL removal in advance of starting up the groundwater extraction system near the shoreline, increases the potential for DNAPL movement to be controlled/contained.

**Riverbank Source Control**

DEQ maintains the expectation that riverbank stabilization/remediation should be included along with the vertical barrier, hydraulic control/containment, and DNAPL removal, as a principal element of the overall source control project (i.e., riverbank source control would be implemented within a similar timeframe). In Section 1.2 of the Preliminary Design Report, NW Natural proposes conducting the

riverbank source control measures alternatives evaluation as part of the uplands FS, and implementing the selected alternatives as remedial actions during the in-water action overseen by EPA.

NW Natural's rational for including the riverbank in the FS has many positive aspects, including freeing up resources to implement higher priority DNAPL and groundwater SCMs (i.e., vertical barrier, and hydraulic control/containment and DNAPL removal systems); taking advantage of in-water action permits; and conducting work within the protective measures established for the in-water action. However, DEQ cannot approve NW Natural's proposal at this time as it influences work being contemplated by EPA. As such, EPA must evaluate how NW Natural's riverbank source control proposal influences in-water action planning, including the draft Gasco sediments cleanup action statement of work being developed.

Additionally, for a riverbank remedial action to be selected and implemented as NW Natural envisions, it must be an approach that can be permitted. Before DEQ approves the proposal, NW Natural will need to consult with agencies involved in the permitting process, including, but not necessarily limited to, US Fish and Wildlife, Army Corps of Engineers, National Marine Fisheries Service, Oregon Department of State Lands, Oregon Department of Fish and Wildlife, and City of Portland Bureau of Development Services.

Based on the information summarized above, NW Natural needs to begin laying the groundwork for the riverbank proposal by preparing a work plan for planning the riverbank preliminary design. The document should include but should not be limited to, the information requested in the March 21st Letter. This document should provide the basis for planning the riverbank project, whether it is done under DEQ or EPA oversight, and inform other involved agencies regarding the scope of the project.

**SPECIFIC COMMENTS**

**Section 1.2.1.** DEQ previously concurred with NW Natural that source control measures intended to mitigate migration of DNAPL and contaminated groundwater to the river are higher priorities than the riverbank element. Furthermore, DEQ acknowledges it is likely given planning and permitting needs, the riverbank source control element will be implemented after the vertical barrier and hydraulic control/containment system. However, DEQ strongly disagrees with language in the section that implies the presence of the vertical barrier and/or hydraulic control/containment system can be used to limit the riverbank SCMs alternative evaluation.

The Preliminary Design Report suggests that prioritizing installation of the vertical barrier potentially justifies a reduced bank stabilization effort. For example, NW Natural indicates that, "DEQ has also verbally commented that engineering approaches to deal with the presence of the wall might drive up the costs of larger scale river bank soil removal alternatives, and thus make them less likely to be selected as preferred alternatives in future evaluations." For clarification, DEQ's position regarding riverbank source control remains consistent with our March 21st Letter in which implementation of the vertical barrier and hydraulic control/containment system is made contingent on satisfying two conditions: 1) future riverbank work will not interfere with implementation of these SCMs; and 2)

these SCMs preserve maximum flexibility in accommodating the range of options for bank soil and river sediment removal and/or stabilization.

DEQ's continues to maintain the most cost effective and environmentally beneficial source control strategy is one that fully integrates the vertical barrier, hydraulic control/containment, and riverbank elements. Planning and design of these source control element separately risks increasing project costs and/or diminishing environmental benefits. Based on meetings discussions, DEQ understood there was agreement that future SCMs alternatives evaluations of the riverbank would be done as if the vertical barrier and hydraulic control/containment system had not been constructed. In other words, any additional costs incurred as a result of working around the vertical barrier and extraction wells, would not be a limiting factor in the riverbank SCMs alternatives evaluation. DEQ expects NW Natural to carry this understanding forward when planning the riverbank source control element.

**Section 1.2.2.** DEQ concurs with NW Natural's proposed sequence of activities up to the third bulleted item. The third bullet should indicate the information requested by DEQ will be used to prepare a work plan for conducting riverbank planning and preliminary design. As discussed above, the work plan will provide the basis for planning the riverbank project, whether it is done under DEQ or EPA oversight, and inform other involved agencies about the scope of the project.

**Section 2.2.** DEQ envisions the Interim Design Report to be the equivalent of a 60% design document that fully considers and incorporates the results of design studies, and establishes the final overall design parameters and configurations of the SCMs. Besides DEQ, the report will be reviewed by EPA and Portland Harbor stakeholders. Subsequent to receiving comments and revising the submittal, the Interim Design Report will be made available for public review and comment.

**Section 3.1, 1st bullet.** The RAO for groundwater should be restated to say that the hydraulic control/containment system will achieve "...complete hydraulic capture of upland groundwater." This revision is more consistent with SCM performance monitoring objectives, which will assess hydraulic capture directly by measuring groundwater levels in extraction wells, monitoring wells, and piezometers. The RAO should be revised in future submittals.

**Section 3.1, 3rd bullet.** Although not mentioned here, DEQ's March 21st Letter points out the RAOs identified in the Groundwater/DNAPL FFS for Segment 1 did not address the fill WBZ. The March 21st Letter informs NW Natural that controlling and containing groundwater in the fill WBZ should be included in planning and design of the vertical barrier (i.e., engineering controls on the upland side of the barrier to prevent DNAPL and/or contaminated groundwater from moving over or around the barrier). Furthermore under "General Comments," the letter communicates DEQ's expectation that control/containment of groundwater in the fill WBZ will be an RAO for riverbank source control along segments 1 and 2. Future submittals should include this information in discussions of SCMs project RAOs.

**Section 3.1, last bullet.** Although DEQ's March 21st Letter indicated NW Natural should control and contain DNAPL migration resulting from operation of the hydraulic control/containment system,

upland DNAPL removal should prevent DNAPL discharges to the river regardless of the mechanism driving its transport.

**Section 3.3, 2nd paragraph.** NW Natural implies DEQ has accepted the location and construction method for the vertical barrier. For clarification, DEQ has not agreed that sheet-pile is the "preferred" wall construction material (DEQ understands it is NW Natural's preferred construction method). DEQ's position on the vertical barrier construction methods has not changed from the March 21st Letter, which indicates the design parameters and construction method(s) of the vertical barrier and hydraulic control/containment system will be determined subsequent to completion of additional field investigations and SCMs planning and design studies (i.e., supplemental Targost® work, DNAPL mobility evaluation, and vibration study).

The supplemental Targost® work has been completed and is included in the Preliminary Design Report. The vibration study is in the final planning stages, and the DNAPL mobility evaluation has not been initiated. Until vertical barrier planning studies have been completed, construction methods and design parameters (location, alignment, and dimensions) cannot be finalized.

**Section 3.3, 5th paragraph.** Although the vibration study and DNAPL movement/mobility evaluation have not been performed, NW Natural proposes a vertical barrier design with depths ranging between -50 and -60 feet msl. The "alternative" barrier is projected to be 10 feet below the current channel (-50 feet msl), and is deepest (-60 feet msl) where the deepest occurrence of DNAPL has been observed.

NW Natural suggests the feasibility of constructing the "alternate" vertical barrier remains to be evaluated by indicating that, "During interim design NW Natural will reevaluate the feasibility of installing the barrier to the alternative depth described above." The SCMs alternative evaluation completed by NW Natural during the Groundwater/DNAPL FFS previously determined sheet-pile and slurry wall construction methods were feasible for use at the site. In the March 21st Letter, DEQ informed NW Natural that until planning studies were complete, a vertical barrier depth of –60 feet msl should be used for planning purposes. Based on meeting discussions, DEQ understood NW Natural expected to achieve this depth by combining clearance trenching with sheet-pile and/or slurry wall construction methods. If there was uncertainty associated with using sheet-pile or slurry wall methods to construct a barrier to -60 feet msl, it should have been acknowledged and incorporated into the vibration study (i.e., mobilize additional equipment to the site for vibration testing).

Before the vibration study is initiated NW Natural should clarify: 1) what the feasibility reevaluation involves; 2) whether sheet-pile and/or slurry wall methods combined with clearance trenching are still expected to achieve a barrier depth of –60 feet msl; and 3) what influence the reevaluation has on the vibration study.

**Section 3.4.** NW Natural should plan to submit the well-fouling prevention plan to DEQ for review upon completion. Note, incorporating shallow groundwater extraction wells (at mid-wall depth) into the hydraulic control/containment system, and assessing different extraction well depths and arrays appear to be deferred to the interim design. DEQ expects this work to done prior to submittal of the

Interim Design Report. For clarification, the results of the modeling work described in Section 4.1, should be provided for DEQ's information, review and comment within 45 days of receipt of this letter.

**Section 3.4, last paragraph page 12.** As discussed under General Comments, NW Natural should evaluate DNAPL movement/mobility as part of the hydraulic control/containment system planning and design process. The results of this evaluation should be considered in assessments of alternate extraction well depths and arrays.

**Section 3.6.** There appears to be a misunderstanding between NW Natural and DEQ regarding the current status of the groundwater treatment system analyte list and discharge concentrations. The analyte list and discharge concentrations shown on Table 1 of Appendix B are from the final Koppers individual NPDES permit. For clarification, the table was provided to NW Natural during a meeting on January 15, 2008 for informational purposes only (i.e., the table does not represent a DEQ "proposal" for analytes and discharge criteria for the Gasco Site).

The analyte list and discharge limits for the groundwater treatment system currently being designed, will be based on: 1) the results of the ongoing treatability studies; and 2) evaluations of discharging treated water consistent with the requirements of an individual NPDES permit application (e.g., using treatability study results to perform a "reasonable potential analysis").

**Section 4.1.** As noted above, the modeling work described in this section of the Preliminary Design Report should be submitted to DEQ within 45 days of NW Natural's receipt of this letter. This will allow DEQ to review the work, and for our more substantive comments to be considered during preparation of the Interim Design Report.

**Section 4.1.2.** It should be noted that the highest groundwater discharge rates do not necessarily coincide with the lowest river stage. Reasonable worst-case scenarios should be based on periods of times corresponding to the highest hydraulic gradient between the uplands and the river, rather than periods of lowest river stage.

**Section 4.2.1.** DEQ considers it premature at this stage of planning to limit the list of technologies available for removing DNAPL from beneath the former effluent ponds. For example, use of horizontal wells is supported by Targost® logs (e.g., TG-8) that have identified relatively thick, laterally connected vertical intervals of mobile DNAPL within and beneath the silt unit. In addition, the silt unit provides a relatively shallow surface above which DNAPL could be removed using trenching methods.

**Section 4.5.** DEQ will expect figures and the particle tracking evaluation described in this section of the report to be completed with 30 days of receipt of this letter. This will allow portions of the NW Natural and/or Siltronic plumes occurring outside of the projected hydraulic control/containment system capture zone to be identified before the Interim Design Report is submitted.

**Figure 1.** The extraction well designations should be numbered sequentially to facilitate discussions of the network.

**Figures 5, 6, and 7.** Figure 4 indicates the bottom of the vertical barrier extends to -50 feet msl or greater. It appears that the depth of the vertical barrier shown on figures 5, 6, and 7 is closer to -40 feet msl. The figures should be reviewed and revised accordingly.

**Figures 4, 5, 6, and 7.** These figures appear to rely on: 1) geologic observations made during the most recently completed geotechnical drilling to monitoring well installation work, and 2) DNAPL intervals identified during Targost® logging work. Regarding DNAPL occurrence, at a number of monitoring well locations (e.g., WS-14), sheen observed during drilling preceded DNAPL entering the installation. The figures should be revised to include depths intervals where evidence of DNAPL (e.g., sheen) was observed during all drilling work completed near the alignment of the proposed vertical barrier (e.g., borings B-29, B-31, B-55, B-58, B-59).

Note that geotechnical borings shown figures 4 and 6 use boring designations used previously for exploratory borings in the northern portion of the Gasco Site. Geotechnical borings should be renamed to avoid confusion in future submittals.

**NEXT STEPS**

DEQ is not requesting the Preliminary Design Report to be revised and resubmitted. DEQ expects the following responses to be prepared by NW Natural within the timeframes indicated.

- Within 14 days and prior to scheduling equipment for the vibration study, NW Natural will clarify: 1) what the feasibility reevaluation of the alternative barrier design involves; 2) whether sheet-pile and/or slurry wall methods combined with clearance trenching are still expected to achieve a barrier depth of –60 feet msl; and 3) what influence the feasibility reevaluation has on the vibration study;
- Within 14 days receipt of this letter, NW Natural will indicate their commitment to perform a DNAPL movement/mobility evaluation by submitting an outline of the approach; and
- Within 45 days of receipt of this letter NW Natural will:
  - Develop cross-sections aligned near the top of the bank that: 1) depict groundwater contamination associated with releases from the NW Natural and Siltronic properties, and 2) the results of particle tracking simulations showing the overlap of groundwater contamination and the hydraulic control/containment system capture zone.
  - Submit the results and analysis of the modeling work described in Section 4.1.

In addition, DEQ expects NW Natural to fully incorporate the comments in this letter, into SCMs planning and design studies and the Interim Design Report.

DEQ acknowledges the significant amount of work the uplands SCMs and in-water sediment cleanup projects represent, and appreciate NW Natural's continued efforts to move these projects forward. Please don't hesitate to contact me if you have any questions regarding this letter.

Sincerely,

Dana Bayuk
Project Manager
Portland Harbor Section

Cc: Sandy Hart, NW Natural
Patty Dost, Schwabe Williamson & Wyatt
Rob Ede, Hahn & Associates
John Edwards, Anchor Environmental
Carl Stivers, Anchor Environmental
Tom McCue, Siltronic
Alan Gladstone and Bill Earle, Davis Rothwell Earle & Xochihua, P.C
James Peale, Maul Foster & Alongi, Inc.
Kristine Koch, EPA
Jim Anderson, DEQ/PHS
Tom Gainer, DEQ/PHS
Matt McClincy, DEQ/PHS
Henning Larsen, DEQ/SRS
ECSI No. 83 File
ECSI No. 184 File

NWN/205
Witness: Robert Wyatt

# BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

## UG 263

## NW NATURAL

**Exhibit Accompanying Direct Testimony of Robert Wyatt**

**Letter Dated March 26, 2010, from DEQ**

**October 2013**

Oregon
Theodore Kulongoski, Governor

**Department of Environmental Quality**
**Northwest Region Portland Office**
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March 26, 2010

*Also Sent Via E-mail*

Mr. Robert J. Wyatt
NW Natural
220 N.W. Second Avenue
Portland, OR 97209

**Re: Interim Design Report**
**Shoreline Segments 1 and 2, NW Natural Property and the Northern Portion of the Siltronic Corporation Property**
**Portland, Oregon**
**ECSI Nos. 84 and 183**

Dear Mr. Wyatt:

The Department of Environmental Quality (DEQ) reviewed the "Interim Design Report – Groundwater Source Control, NW Natural Gasco Site" dated November 2009 and received November 10, 2009 (Interim Design Report). The Interim Design Report represents the first source control document to incorporate the findings and results of source control measures (SCMs) design support and feasibility studies. Anchor QEA, LLC (Anchor) prepared the Interim Design Report on behalf of NW Natural.

In addition to the Interim Design Report, DEQ reviewed the "NW Natural and Siltronic Groundwater Treatment Pilot Study Report" dated December 2009 and received January 21, 2010 (Pilot Study Report). The Pilot Study Report was prepared by Sevenson Environmental Services, Inc. for NW Natural. Comments to the Pilot Study Report are combined with the comments to Appendix C (Groundwater Treatment System Design) of the Interim Design Report for completeness.

The primary purpose of this letter is to inform NW Natural that DEQ:

- Accepts NW Natural's recommendation to evaluate the vertical barrier and dense non-aqueous phase liquid (DNAPL) removal SCMs in the uplands feasibility study (FS);
- Approves the locations, depths, and designs of the two northern-most extraction wells (i.e., PW-9 and PW-10);
- Provides conditional approval of the locations of four extraction wells (i.e., PW-1, PW-2, PW-7, and PW-8) subject to DEQ's review of additional information to be provided by NW Natural;
- Expects the need for an additional extraction well to be evaluated southeast (upstream) of the upstream-most extraction well (i.e., PW-1); and
- Does not approve extraction wells located along the vertical barrier alignment (i.e., PW-3 through PW-6) and will defer these installations to the uplands FS so hydraulic control and containment (HC&C) along this portion of Segment 1 can be evaluated in the context of DNAPL remedial action alternatives.

DEQ's comments in this letter regarding the vertical barrier and/or HC&C along the barrier alignment should be carried forward and addressed during the uplands FS.

## BACKGROUND

DEQ determined the shoreline of property owned by NW Natural (NW Natural Property) and the northern portion of the property owned by Siltronic Corporation (Siltronic Property) are high priorities for source control. The portion of the shoreline identified as the highest priority for source control (Segment 1) extends from near the south side of the Fuel and Marine Marketing (FAMM) leasehold on the NW Natural Property, to upstream of the former "Gasco Facility" manufactured gas plant (MGP) effluent ponds on the Siltronic Property. Segment 1 coincides with the heaviest MGP-related impacts identified near the river, including DNAPLs, contaminated groundwater, and impacted riverbank soils. It also includes the portion of the Siltronic Property where releases of volatile organic compounds (VOCs) from Siltronic's former solvent underground storage tank system (Former UST System) have commingled with DNAPL and groundwater contamination resulting from the historic operations of the Gasco Facility.

The segment of NW Natural's shoreline extending north of Segment 1 to the downstream property line with US Moorings (Segment 2) is also considered a high priority for source control, primarily due to the presence and concentrations of MGP chemicals of interest (COI), particularly cyanide, in riverbank soils and groundwater. A third shoreline segment (Segment 3) extends from upstream of the former effluent ponds to the upstream Siltronic Property line. A source control evaluation of Segment 3 is ongoing.

## SOURCE CONTROL MEASURES PLANNING AND DESIGN

NW Natural completed the Groundwater/DNAPL Focused Feasibility Study (FFS) for Segment 1 and Segment 2 in November 2007[1]. The Groundwater/DNAPL FFS presents the remedial action objectives (RAOs) for source control, which were jointly developed by NW Natural and DEQ including: 1) preventing DNAPL in the uplands from migrating to the Willamette River (RAO #1); and 2) hydraulic capture of upland groundwater discharging to the river. The Groundwater/DNAPL FFS also presents NW Natural's evaluation of source control measures (SCMs) alternatives and recommended SCMs to achieve RAOs. NW Natural's recommendation combines a HC&C system along shoreline segments 1 and 2 with a vertical barrier along the northern portion Segment 1 (i.e., the southern portion of the NW Natural Property). DEQ approved NW Natural's recommendation subject to conditions and comments detailed in a March 21, 2008 letter (March 21st Letter) which included, but are not limited to the following:

- Adding extraction wells above the bottom of the vertical barrier with the objective increasing horizontal and upward vertical gradients operating behind the barrier, and reducing the potential for DNAPL to migrate below and beyond the influence of deeper extraction wells.

[1] Anchor QEA, LLC, 2007, "Groundwater/DNAPL Source Control Focused Feasibility Study – NW Natural 'Gasco' Site," October 12 (amended November 9th), and report prepared for NW Natural.

- Constructing engineering controls in the fill water-bearing zone (WBZ) on the upland side of the barrier to prevent DNAPL and/or contaminated groundwater from moving over or around the vertical barrier.
- Including DNAPL removal as a SCM to the extent necessary to control and contain the potential movement of DNAPL from former effluent ponds on the NW Natural and Siltronic properties that could result from operation of the hydraulic control/containment system.

Subsequent to completion of the Groundwater/DNAPL FFS, NW Natural and DEQ participated in a series of meetings to work through the more substantive issues identified in the March 21st Letter and establish the SCMs planning and design process, including identifying and agreeing on "preliminary," "interim," and "final" design steps. Preliminary design steps included conducting studies to further assess the feasibility of constructing major elements of source control (e.g., vibration study in support of the vertical barrier; groundwater treatability study and treatment system pilot study to support evaluations of HC&C).

The Preliminary Design Report[2] prepared by NW Natural summarizes the status of SCMs planning and design based on the outcomes of the meetings. In addition, the document summarizes agreements reached by NW Natural and DEQ regarding SCMs design, the preliminary design for the principal source control elements, and those aspects of source control requiring further investigation so informed decisions could be made regarding sequencing SCMs implementation (e.g., DNAPL mobility evaluation). DEQ provided comments to the Preliminary Design Report in a letter dated August 22, 2008 (August 22nd Letter). DEQ's expectations regarding the content of the next SCMs planning document (the "Interim Design Report") are also communicated in the August 22nd Letter. The content of the Interim Design Report was further clarified by DEQ in a letter dated September 24, 2009 (September 24th Letter).

The Interim Design Report represents the first source control document to incorporate the findings and results of SCMs design support and feasibility studies. Based on the outcome of planning meetings and support studies, the Interim Design Report confirms the feasibility of NW Natural's SCMs alternatives recommendations made in the Groundwater/DNAPL FFS, and provides the interim design for a combination of SCMs, including a:

- Vertical barrier constructed of sheet piles extending from just north of the Siltronic property line to the south side of the FAMM leasehold; and
- HC&C system consisting of a series of ten extraction wells along shoreline segments 1 and 2, including a groundwater treatment system sized to treat up to 400 gallons per minute (gpm).

In addition, the Interim Design Report provides NW natural's recommendations for modifying SCMs implementation by:

- Constructing the HC&C system, including the groundwater treatment system as soon as practicable after finalizing the design and obtaining necessary permits; and
- Further evaluating the vertical barrier and DNAPL removal SCMs in the uplands FS.

[2] Anchor QEA, LLC, 2008, "Preliminary Design Report – Groundwater Source Control, NW Natural Gasco Site," June, a report prepared for NW Natural.

A copy of the Interim Design Report was provided to the U.S. Environmental Protection Agency (EPA) for review. DEQ comments regarding the Interim Design Report are provided below and incorporate EPA's comments.

## GENERAL COMMENTS

**Vertical Barrier and Uplands Feasibility Study.** Several years ago DEQ prioritized source control over the upland RI/FS. The goal of source control was to identify high priority contaminant transport pathways to the river, and design and implement SCMs to control those pathways so in-water actions could proceed without the risk of recontamination. Completion of the site-wide RI/FS was to follow SCMs design. As such, source control planning and design was prioritized over the RI and Risk Assessment. NW Natural and DEQ have been working towards fully implementing source control. However, given the scale, magnitude of contamination, and complexity of the source control project, particularly with respect to DNAPL, timelines for designing and implementing SCMs have been extended and now reasonably overlap with the uplands FS and in-water sediment project. Given this information, DEQ concludes:

- Construction of the vertical barrier prior to initiating the uplands FS is not likely to occur; and
- Benefits associated with early implementation of the vertical barrier SCM would be much reduced.

DEQ further concludes completing the uplands RI/FS on a parallel track with the in-water sediment project will benefit uplands and in-water remediation overall and concurs with the reasons NW Natural lists in Section 3.3.1 of the Interim Design Report, including:

- The uplands FS could identify alternative technologies, or combinations of technologies, including DNAPL removal, soil removal, alternative configurations of vertical barriers, that would be more effective at achieving RAO #1 than the vertical barrier identified in the Interim Design Report;
- Evaluating the vertical barrier during the uplands FS will allow it to be considered in the context of a site-wide remedial action strategy; and
- Postponing the vertical barrier will facilitate development of more fully integrated upland and in-water sediment remedial actions.

Based on the information summarized above, DEQ approves NW Natural's proposal to defer evaluation of the vertical barrier and DNAPL removal SCMs to the uplands FS. Furthermore, NW Natural should postpone installation of extraction wells PW-3 through PW-6 to the uplands FS so HC&C along this portion of the shoreline can be evaluated in the context of DNAPL remedial action alternatives.

As discussed above, NW Natural and DEQ identified preventing migration of DNAPL from the uplands to the Willamette River to be an RAO for source control (RAO #1). Remedial alternatives to address source control RAOs, including RAO #1, were evaluated in the Groundwater/DNAPL FFS. Based on the work documented in the Groundwater/DNAPL FFS, NW Natural determined that of the SCM alternatives carried forward into detailed evaluation, the vertical barrier and HC&C combination scored highest overall. Notably the combination scored higher than HC&C alone in four of the five "Effectiveness" sub-categories, primarily because the vertical barrier physically blocks DNAPL

migrating towards the river. DEQ's March 21st Letter approved, subject to conditions and comments, NW Natural's recommendation for a SCMs alternative combining a vertical barrier along the northern portion Segment 1 (i.e., the southern portion of the NW Natural Property) with HC&C along shoreline segments 1 and 2.

NW Natural should be advised that source control RAO #1 will be an RAO in the uplands FS. DEQ's acceptance of NW Natural's recommendation to postpone final design and construction of the vertical barrier pending the outcome of the uplands FS is subject to the following conditions:

- A barrier must be carried forward into the detailed analysis of remedial action alternatives for RAO #1 in the uplands FS; and
- The vertical barrier carried forward into detailed analysis will be 625 feet long and constructed using sheet pile methods to a depth of -60 feet City of Portland datum (COP).

DEQ expects NW Natural to acknowledge these conditions in writing prior to moving forward with final design of the HC&C system discussed below. Construction feasibility and design support studies show pile driven vertical sheet pile barriers can be constructed to depths of up to 90 feet below ground surface (bgs). The studies not only show construction is feasible, but provide information to support design, including identifying barrier materials, construction methods and equipment, and approaches for monitoring field activities to reduce potential impacts to the adjoining Siltronic operation(s) during construction. Given DEQ's determination, NW Natural should carry any comments in this letter pertaining to the vertical barrier and/or HC&C along the barrier alignment forward into the FS.

**Groundwater Modeling.** NW Natural relies on groundwater modeling to develop conclusions regarding the influence of the HC&C system on the alluvial WBZ. The groundwater model was originally developed to assess groundwater flow beneath the site and support evaluations of SCMs alternatives in the Groundwater/DNAPL FFS, including HC&C and the groundwater treatment system. The model simplified subsurface conditions by simulating only the main elements of the site hydrogeology (i.e., fill unit, upper silt unit of the alluvium; and alluvial sands subdivided into an upper and lower based on hydraulic properties). Given the model encompasses an area much greater in size than the NW Natural and Siltronic properties, DEQ considered the model suitable for these purposes. The groundwater model was subsequently used at DEQ's request to assess the depth of the vertical barrier and the potential influence pumping extraction wells near the shoreline could have on DNAPL movement beneath the former effluent ponds.

Since the Groundwater/DNAPL FFS, NW Natural consistently indicates the HC&C system will capture groundwater over the full thickness of the alluvial WBZ across shoreline segments 1 and 2. Since completion of the focused feasibility study, interpretations of the alluvium stratigraphy have been refined. As shown in the geologic cross-sections presented in the Interim Design Report, the stratigraphy of the alluvial WBZ is predominantly fine and medium sand (upper alluvium) overlying medium sand (lower alluvium). A gravel unit occurs in the deepest portions of the alluvium in contact with Columbia River Basalt. Depending on location and depth, layers and lenses of fine-grained silt, sandy silt, and silty sand complicate the stratigraphy of the alluvium. In general, the proportion of fine-grained material is greatest in the upper alluvial sand where the greatest mass of contamination occurs. The amount of fine-grained material noticeably increases in the lower alluvium beneath the Siltronic

Property. The Interim Design Report presents for the first time NW Natural's interpretation of a silt unit in the lower alluvium between elevations of approximately -100 and -125 feet. The lower silt unit and packages of fine-grained layers beneath the northern portion of the Siltronic Property are interpreted by NW Natural to act as an aquitard in the lower alluvial WBZ that potentially restricts vertical migration of contaminated groundwater into deeper intervals of the alluvial WBZ.

Although the site stratigraphy has been refined with time, DEQ understands for the modeling NW Natural conducted for the Interim Design Report the only change made to the previous model is the addition of the lower silt unit. Based on this information, DEQ considers there to be much uncertainty associated with NW Natural's conclusions regarding the capability of the HC&C system to influence the full thickness of the alluvial WBZ within a reasonable timeframe. Uncertainties are primarily associated with the model's ability to account for the presence of fine-grained layers and lenses within, above, and below the screened intervals of many extraction wells. Many of these fine-grained layers project beyond the riverbank and out under the river. The potential for fine-grained material to influence and/or limit modeling predictions and/or the performance of the HC&C system is not discussed in the Interim Design Report. To address these uncertainties and reduce the influence of fine-grained layers on contaminated groundwater capture and contaminant mass removal, extraction wells should be located where the highest concentrations of MGP constituents and VOCs occur. The extraction wells affected by this comment are discussed further below under DEQ's "Hydraulic Control and Containment" comments.

NW Natural is currently in the process of conducting long-term variable rate pumping tests using three test extraction wells and multiple observation wells constructed in the fill WBZ and upper and lower alluvial WBZ. NW Natural indicates the primary purpose of the tests is to support planning of the in-water sediment project by assessing the influence pumping wells in the uplands has on groundwater levels beneath the river. As indicated on DEQ's letter dated January 10, 2010, NW Natural should use test data to assess the lateral and vertical influence of pumping test wells on the fill WBZ and alluvial WBZ. NW Natural's final data interpretations, conclusions, and analysis of the tests, including the results of any groundwater modeling, should be incorporated into the HC&C system final design document.

**Hydraulic Control and Containment System.** The Interim Design Report proposes implementing a HC&C system consisting of ten extraction wells located along shoreline Segment 1 and Segment 2. Based on review of the Interim Design Report and acceptance of NW Natural's recommendation to evaluate the vertical barrier in the uplands FS, DEQ has made the following determinations regarding the proposed HC&C system.

- The locations and depths of extraction wells PW-9 and PW-10 are approved.
- The locations and depths of extraction wells PW-1, PW-2, PW-7, and PW-8 are conditionally approved subject to NW Natural conducting additional evaluations per DEQ's comments below. The outcome of these evaluations should be presented in the final design document.
- An additional extraction well located upstream (i.e., southeast) of PW-1 may be warranted and should be evaluated in the final design document.
- Extraction wells PW-3 through PW-6 are not approved and should be further evaluated during the uplands FS in the context of DNAPL remedial action alternatives.

DEQ's rational for these determinations is provided below.

Extraction wells PW-1 PW-2, PW-7, and PW-8. There is insufficient information provided in the Interim Design Report to evaluate how the locations and depths of these four extraction wells correspond to dissolved phase MGP contamination (PW-7 and PW-8), and commingled MGP constituents and VOCs (PW-1 and PW-2). As discussed above, given the uncertainties of groundwater modeling the wells should be located within the highest concentration portions of groundwater plumes to maximize to the extent practicable, contaminant capture and mass removal. The only information provided in the Interim Design Report regarding contaminant distributions are shown for total and free cyanide (see figures 12a and 12b) which is inadequate for this purpose.

NW Natural should prepare figures for the final design document showing how the locations of these extraction wells relate to groundwater contamination as shown by data collected from uplands monitoring wells (not nearshore borings). The figures should show extraction wells with MGP and VOC COI along cross-section A-A'. The MGP and VOC COI shown in the figures should include, but not necessarily be limited to, benzene, naphthalene, total cyanide, and vinyl chloride, and the rational for selecting COI must be provided. In preparing the figures, NW Natural should use reconnaissance groundwater data as needed to fill data gaps. For example, the VOC Plume FFS[3] prepared by Siltronic provides cross-sectional views of VOCs, including trichloroethene, cis-1,2-dichloroethene, and vinyl chloride, that are useful for locating extraction wells PW-1 and PW-2 (see figures 1-3a, 1-3b, and 1-3c).

Additional Extraction Well. Figure 2-10 summarizes groundwater data for selected MGP COI collected from monitoring wells located in the upstream portion of shoreline Segment 2 and the length of Segment 1. Detected concentrations of total and free cyanide between approximately 0 and -80 feet in elevation exceed Joint Source Control Strategy[4] (JSCS) criteria upstream of the WS-8 and WS12 monitoring well clusters. This comment also applies to detected concentrations of VOCs. Furthermore, the capture zone for extraction well PW-1 shown by Figure 4-2 does not appear to extend far enough upstream to intercept groundwater contamination documented at the WS-8 and WS-12 monitoring clusters (i.e., groundwater in the alluvial WBZ contaminated by MGP and VOC COI could by-pass the HC&C system on the upstream side). Based on this information an additional extraction well may be warranted upstream of PW-1. The need for an additional extraction well should be fully evaluated in the final design document.

Extraction Wells PW-3 through PW-6. Extraction wells PW-3 through PW-6 are located along the most contaminated portion of shoreline Segment 1. Contamination includes MGP DNAPL, groundwater impacted by MGP constituents, and groundwater impacted by MGP constituents and VOCs. The four extraction wells proposed in the Interim Design Report are similar in number and depth as those NW Natural proposed in the Groundwater/DNAPL FFS. As indicated in the March 21st

[3] Maul Foster and Alongi, Inc., 2007, "Focused Feasibility Study - Siltronic Corporation, Portland, Oregon," October 23 (amended December 19, 2007), a report prepared for Siltronic Corporation.
[4] EPA and DEQ, 2005, "Portland Harbor Joint Source Control Strategy – Final," December (note Table 3-1 revised July 16, 2007), a guidance document prepared jointly by the US Environmental Protection Agency and Oregon Department of Environmental Quality.

Letter, DEQ concluded from drilling observations and TarGOST® work, extraction wells could potentially mobilize and spread DNAPL. DEQ also informed NW Natural that potential expansion of the distribution of DNAPL is a significant factor for SCMs planning and design. As such, DEQ did not approve NW Natural's recommendation in the focused feasibility study because:

- Extraction wells are placed below much of the DNAPL shown in cross-sections and pumping the wells will increase the potential for coalescence and downward vertical migration of DNAPL.
- Coalescence, pooling, and movement of DNAPL cannot be reliably predicted or monitored.

Since the Groundwater/DNAPL FFS was submitted, SCMs planning for this portion of Segment 1 has included a vertical barrier and "shallow" and "intermediate" depth extraction wells. The barrier and extraction wells were intended to operate in combination to physically block DNAPL migrating towards the river (vertical barrier); increase horizontal and upward vertical gradients operating behind the barrier ("shallow" depth extraction wells); and control and contain groundwater in the alluvial WBZ beneath the barrier ("intermediate" depth extraction wells). The Interim Design Report recommends deferring evaluation of the vertical barrier to the uplands FFS and removes shallow extraction wells from the proposed design.

Based on the information provided in the Interim Design Report, and consistent with determinations made previously, DEQ does not approve: 1) drilling and installation of extraction wells PW-4, PW-5, and PW-6; or 2) operation of PW-3-81 and PW-3-118. DEQ considers it likely HC&C will be carried forward into detailed analysis of remedial action alternatives in the uplands FS. For the most impacted portion of Segment 1, the uplands FS should evaluate the locations, depths, timing of construction, and operation of extraction wells with DNAPL remedial action alternatives.

## SPECIFIC COMMENTS

**Section 1.1.** NW Natural indicates DEQ has not commented on two documents relevant to the Interim Design Report, including the Gradient Evaluation Report[5] and the DNAPL Mobilization Evaluation[6]. The two documents use groundwater modeling to:

- Assess changes in the horizontal and vertical hydraulic gradients in the alluvial WBZ associated with a variety of shoreline SCMs scenarios under reasonable worst-case combinations of groundwater flow and river channel configuration; and
- Perform preliminary assessments of DNAPL mobility and movement, including assessing the potential for the HC&C system to mobilize DNAPL beneath the former upland effluent ponds.

The content of the two documents was developed by NW Natural and DEQ during a series of meetings convened to work through the more substantive issues identified in DEQ's March 21st Letter. In addition, the documents respond to DEQ's August 22nd Letter.

[5] Anchor QEA, LLC, 2008, "Groundwater Flow Model and DNAPL Evaluation Supplemental Report," October (supplemented with supporting figures on March 26, 2009), a report prepared for NW Natural.
[6] Anchor QEA, LLC, 20009, "Evaluation of Potential DNAPL Mobilization in Former Effluent Pond Area by Shoreline Source Control Extraction Wells, Gasco Site, Portland, Oregon," March 18, a technical memorandum prepared for NW Natural.

As indicated in the August 22nd Letter, DEQ expected the Gradient Evaluation Report to be performed, "...with the specific objective of assessing the depth of the vertical barrier proposed in the Preliminary Design Report (i.e., between -50 and -60 feet mean sea level [msl])." The DNAPL Mobilization Evaluation responded to DEQ's March 21st Letter and August 22nd Letter by supplying DEQ with a basis for considering NW Natural's proposal to implement uplands DNAPL removal after construction of the vertical barrier and HC&C SCM combination.

Although detailed review comments were not provided, via a June 5, 2009 letter DEQ informed NW Natural the two documents provide a technical basis for: 1) carrying -60 feet msl forward into the Interim Design Report as the design elevation for the bottom of the vertical barrier; and 2) moving forward with developing plans and schedules to implement uplands DNAPL removal after construction of the vertical barrier and HC&C SCMs.

**Section 1.2.** Although not mentioned here, the March 21st Letter points out the RAOs identified in the Groundwater/DNAPL FFS for Segment 1 did not address the fill WBZ. Certain conditions and general comments in the March 21st Letter informed NW Natural that:

- Controlling and containing groundwater in the fill WBZ should be included in planning and design of the vertical barrier (i.e., engineering controls on the upland side of the barrier to prevent DNAPL and/or contaminated groundwater from moving over or around the barrier); and
- Absent information, data, and/or analysis indicating the alluvial WBZ extraction wells will control/contain groundwater in the fill WBZ, DEQ expected evaluations of riverbank remedial alternatives to include this as an RAO.

The Interim Design Report does not include an approach for controlling and containing groundwater in the fill WBZ behind the vertical barrier. Without information regarding how groundwater in the fill WBZ will be addressed during design and construction of the vertical barrier, DEQ considers the interim design of the vertical barrier to be incomplete. For clarification, controlling groundwater flux in the fill WBZ must be achieved by NW Natural whether the barrier is constructed or not. Furthermore, NW Natural has not provided information, data, and/or analysis regarding the second item.

NW Natural is currently conducting an evaluation of the influence of pumping uplands test wells on groundwater levels beneath the river in Segment 2. These tests will provide information to preliminarily assess the capability of extraction wells in the alluvial WBZ to influence shallow groundwater in the fill WBZ. DEQ expects this information to be fully incorporated into the final SCMs design document.

**Section 1.3.** NW Natural uses the term "riverbank stabilization" throughout this section of the Interim Design Report. The term pre-supposes one type of riverbank remedial alternative and should be revised to reference "riverbank cleanup." NW Natural will also need to develop an approach for evaluating the effectiveness of the upland remedy against performance standards for COI. Groundwater in the fill WBZ represents a complete high priority contaminant transport pathway from the uplands into the in-water sediment project area. As such, measuring groundwater flux should also be included as a performance monitoring criterion for the remedy. For clarification, mitigating

groundwater flux to the river via the fill WBZ is an uplands source control RAO and is subject to DEQ oversight.

**Section 1.4.** Regarding the schedule NW Natural references here, as indicated in the March 21st Letter, DEQ prioritized source control over the upland RI/FS several years ago. The source control strategy involved implementation of source control as a removal action to cut-off DNAPL migration to the river and MGP and VOC contamination being transported from the uplands to the river via groundwater. The goal for implementing SCMs was to address high priority contaminant transport pathways to the river and allow in-water actions to proceed without the immediate risk of recontamination from an uncontrolled upland source. The second phase of the source control strategy, a site-wide RI/FS resulting in a comprehensive final remedy would follow SCMs implementation. The SCMs planning and design process is ongoing.

DEQ disagrees with two assertions made by NW Natural in the fourth paragraph of this section. NW Natural indicates that, "...upland DNAPL is not currently discharging to river sediment via subsurface pathways," and that, "...the distribution of upland DNAPL will not be significantly impacted by operation of the source control wells..." DEQ addresses these assertions in our comments to Section 2.1.3 (second paragraph), Section 4.2.1.4, and in the General Comments.

**Section 2.1.1.** For clarification, although work documented in the Offshore Investigation Report[7] was done under DEQ oversight, DEQ was primarily interested in investigations designed to assess potential ongoing uplands contaminant transport pathways (e.g., direct discharge, groundwater) as sources of contamination to the river. This data was incorporated into the Groundwater/DNAPL FFS and the SCMs planning and design process that followed. A significant amount of the work performed during the offshore investigation was intended to support the Portland Harbor in-water RI/FS being performed by the Lower Willamette Group under EPA's oversight. Furthermore, off-shore investigatory work supplied surface water, sediment, transition zone water, and shallow groundwater data to assist planning of the in-water sediment project also being overseen by EPA.

This section of the Interim Design Report references numerous geologic cross-sections. DEQ requests an additional cross-section be developed for the final design document which depicts the area of deeper DNAPL occurrence between borings TG-10 to B-4B shown on Figure 2-3b. This additional cross-section would be drawn between existing cross-sections D and E.

**Section 2.1.1, 5th and 6th paragraphs.** The Interim Design Report indicates, "The basalt is a no-flow boundary in the MODFLOW model that has been developed by SS Papadoulos (SSPA) for the site." This assertion is in error. The revised groundwater model report[8] indicates, "As described on page 22 of the model summary report, the basalt is not a no-flow boundary. The basalt contributes flow to the model through the upgradient specified head boundary." In addition, observations made during decommissioning of cathodic protection boreholes provide site-specific evidence the basalt recharges

[7] Anchor QEA, LLC, 2008, "Offshore Investigation Report - NW Natural 'Gasco' Site," February, a report prepared for NW Natural.
[8] Anchor QEA, LLC, 2008, "NW Natural Groundwater Model," April 25, a document prepared for NW Natural.

the alluvial WBZ. During decommissioning, water-bearing zones were observed in the basalt at approximately 80 feet bgs, and by downhole video surveys between 106 and 145 feet bgs. These zones occur at depth intervals that project horizontally into the alluvial WBZ. Based on the results of modeling and seepage meter data, groundwater flux through the alluvial WBZ into the river was estimated to be approximately 250 gpm.

**Section 2.1.1, 6th paragraph.** The Interim Design Report indicates, "Groundwater in the Fill WBZ recharges the underlying alluvium and discharges to the river." DEQ concurs with NW Natural's conclusions that where the upper silt unit is thin, absent, or penetrated by secondary porosity (e.g., root and/or rootlet voids) groundwater in the fill WBZ would tend to migrate vertically downward. Based on data collected on the NW Natural and Siltronic properties, vertical migration through the silt unit by DNAPL and contaminated groundwater has been observed and documented. Although vertical groundwater migration through the silt has been documented, based on available information, including from dewatering the LNG tank basin, DEQ interprets overall groundwater flux through the fill WBZ to be laterally directed towards the river. The magnitude and timing of groundwater flux through the fill WBZ represents an information need for uplands SCMs planning and design. When the results of the evaluation NW Natural is conducting to assess the influence of pumping test wells on groundwater levels under the river are available, SCMs alternatives for the fill WBZ will need to be identified in the final design document and further evaluated in the uplands FS.

**Section 2.1.2.** DEQ notes the silt unit directly underlying the surficial fill is not mentioned in this section of the report. The silt unit comprises the upper-most material of the alluvium. Not mentioning the upper silt unit appears to be an oversight as NW Natural and DEQ acknowledge it influences the nature and extent of contamination in the surficial fill, including the distribution of DNAPL. From a hydrogeologic standpoint the upper silt unit is considered the boundary between the fill WBZ and the alluvial WBZ. The configuration of the top of the upper silt unit, as well as its thickness and hydraulic properties influence the horizontal movement of MGP DNAPL and shallow groundwater in the fill WBZ, and the vertical migration of DNAPL and groundwater from the surficial fill WBZ into the alluvial WBZ. A description of the geology and hydrogeology of the upper silt unit should be included in the final design document for completeness.

**Section 2.1.2.1.** NW Natural's interpretation of the presence of a hydrogeologically significant silt unit is presented in this section of the Interim Design Report. DEQ understands NW Natural relied on observations made during drilling of the shoreline monitoring wells and TarGOST® logs in interpreting the depth, thickness, and lateral extent of the silt unit. DEQ provides preliminary concurrence with NW Natural's interpretations regarding "lower" silt unit based on drilling observations. However, DEQ is not aware of work done by NW Natural to correlate TarGOST® logging data to the subsurface geology of the site. This information should be provided as a supplement to Appendix H to document NW Natural's basis for interpreting silt unit occurrence and for completeness.

**Section 2.1.3, 1st paragraph.** This section of the Interim Design Report provides NW Natural's summary of offshore groundwater conditions. NW Natural indicates that because of low river levels, groundwater seepage data collected during late summer and fall are expected to be representative of seasonal maximums. NW Natural envisions the HC&C system operating over a long period of time.

As such, the system will need to accommodate a dynamic system influenced by seasonal changes in natural recharge, river stages and tidal influence. It is recommended NW Natural run the MODFLOW model in a transient state to verify the model's ability to simulate changing groundwater flux and hydraulic head conditions resulting from these influences. One method NW Natural should consider and which utilizes currently available tidal lag time data is to run and calibrate transient simulated head conditions (as needed) to observed heads changing over time due to actual tidal and river stage influences.

Regardless of seasonal variations in groundwater flux or the potential for additional sources of water to be added to the treatment process (e.g., fill WBZ, LNG tank basin), groundwater source control planning accommodated uncertainties through designing the treatment system for 400 gpm. NW Natural should confirm DEQ's understanding or provide clarifying information.

**Section 2.1.3, 2nd paragraph.** NW Natural summarizes their conclusions regarding the distribution and source of DNAPL observed during offshore investigations in this paragraph, asserting, "...DNAPL has not migrated from the upland alluvium into river sediments." NW Natural further indicates DNAPL in sediments, "...is sourced from direct discharge of MGP residuals from upland waste management areas into the river, not from DNAPL migration from the upland Alluvium WBZ." DEQ disagrees with NW Natural's conclusions about the distribution of MGP DNAPL in river sediment. As shown by figures 2-12a and 2-12b, the borings on which NW Natural bases its assertions are approximately 200 feet apart. In other words, there are too few borings spaced too widely apart to support NW Natural's assertions made in this section, Section 3.1, and Section 3.3.1. Furthermore, based on DEQ's review of the Offshore Investigation Report, evidence of MGP DNAPL having migrated from uplands source areas out under the river exists at one of the nearshore drilling locations. Field measurements made during drilling of Boring GS-09 detected DNAPL approximately 10 feet deeper than the bottom of MGP material reasonably interpreted as resulting from direct discharge/placement (i.e., approximately 10 feet deeper than –17 feet COP). Figures 2-12a and 2-12b of the Interim Design Report show the deeper occurrence of DNAPL measured at GS-09.

**Section 2.2.** DEQ notes the Army Corps of Engineers U.S. Moorings facility adjoins the NW Natural Property to the north.

**Section 3.1, 2nd paragraph.** NW Natural indicates DEQ's September 24th Letter required a vertical barrier be designed to block DNAPL migrating to the river. As discussed in the General Comments, inclusion of the vertical barrier as a SCM is an outcome of the Groundwater/DNAPL FFS completed by NW Natural. For clarification, the September 24th Letter directed NW Natural to complete the Interim Design Report that DEQ understood was going to provide the interim design for a combination of SCMs, including a:

- Vertical barrier constructed using either sheet-pile or slurry wall methods with dimensions of approximately 625 feet long by 90 feet deep, extending from just north of the Siltronic property line to the south side of the FAMM leasehold.
- Hydraulic control and containment system consisting of a series of "intermediate" depth extraction wells evenly spaced along segments 1 and 2, and "shallow" extraction wells located behind the vertical barrier.

- Water treatment system sized to treat 400 gpm.

The Interim Design Report was also to include a sequencing plan to integrate SCMs implementation, a performance monitoring program to assess the effectiveness of SCMs through monitoring groundwater levels and chemistry along segments 1 and 2, and a general approach and timeframe for implementing upland DNAPL removal in the area of the former effluent ponds.

Based on DEQ's review, the Interim Design Report is incomplete as engineering controls for the fill WBZ and shallow extraction wells located behind the vertical barrier are not included in the document. For clarification, DEQ is accepting the Interim Design Report due to our: 1) approval of NW Natural's proposal to defer the vertical barrier to the uplands FS, and 2) determination that HC&C behind the barrier should also be deferred to the FS and evaluated in the context of DNAPL remedial action alternatives. The status of evaluating source control of the fill WBZ and the information needed for source control planning are discussed in DEQ's General Comments and comments to sections 1.2, 1.3, and 2.1.1.

**Section 3.1, 4th paragraph.** DEQ's comments to the second paragraph of Section 2.1.3 apply here.

**Section 3.2.1.** According to NW Natural, the TarGOST® detector, "...is reliable for the detection of the presence of tar and oil, but cannot differentiate between tar and oil or determine if the material is mobile." In the next paragraph figures depicting the interpreted occurrence of "DNAPL (tar and oil)" in the fill and alluvium to depths greater than 100 feet bgs are referenced. Previously in Section 3.1, NW Natural indicates MGP tar does not migrate. Taken together it appears NW Natural is suggesting mixtures of immobile tar and mobile oil occur in the alluvium.

For clarification, DNAPL detected in the alluvium (i.e., below the top of the upper silt unit) must be mobile. According to information provided by NW Natural in a variety of documents, MGP waste management areas on the NW Natural and Siltronic properties occur entirely within the fill (i.e., above the top of the upper silt unit whether modified by historic site operations or not). For MGP DNAPL to be detected in the alluvium by the TarGOST® logging equipment, the material must have migrated to the location.

**Section 3.2.2.** DEQ's comments to sections 4.2.1.3 and 4.2.1.4 apply here.

**Section 3.3.1.** DEQ's General Comment regarding the vertical barrier and the uplands FS applies here.

**Section 3.3.2.** DEQ has numerous comments regarding this section of the Interim Design Report.

- NW Natural indicates in sections 3.2 and 3.3 that the location and depth of the vertical barrier were planned to block DNAPL migrating to the river navigation channel. The river channel occurs at an approximate elevation of -40 COP. As DEQ determined previously, a vertical barrier constructed to -40 feet COP is inadequate because this depth does not consider potential deepening of the channel during the in-water sediment project and/or navigation channel dredging (i.e, there are no safety factors incorporated into the -40 feet design depth). In addition, Figure 2-3b shows much of the DNAPL in the southern section of barrier occurs between elevations of -40 and -60 feet.

Furthermore, DEQ continues to consider ongoing migration of DNAPL from the uplands to areas beneath the river to be an unacceptable condition. Even absent direct discharge into the river, depending on the lateral and vertical depth of occurrence DNAPL represents an ongoing source of dissolved-phase recontamination to the river channel.

- NW Natural indicates in the second paragraph TarGOST® investigations did not result in changes to the depth or lateral extent of DNAPL such that modifications were made to the barrier locations shown in the Groundwater/DNAPL FFS and Preliminary Design Report. DEQ notes the bottom of the vertical barrier proposed in Groundwater/DNAPL FFS was -40 feet COP, while the Preliminary Design Report envisioned a barrier constructed to elevations between -50 and -60 feet COP.
- It appears the top of steel sheets are at elevation +20 feet, or approximately 5 to 15 feet bgs. NW Natural indicates the bottom of the clearing trench will be excavated to 20 feet bgs and backfilled prior to driving sheets. As such, it is not clear how the top of the sheet will be driven through the backfill to depth.
- DEQ considers the absence of groundwater controls on the fill WBZ to be a design deficiency which must be addressed if the vertical barrier is selected as a component of the final remedy for the uplands.

NW Natural should be advised that should the vertical barrier(s) be selected as a component of the final remedy, additional more detailed modeling work will be needed to support final design. For example, more detailed modeling could include reducing the grid spacing in the vicinity of the barrier and using the horizontal flow barrier package available in MODFLOW to develop more realistic representations of the vertical barrier in the simulations.

**Section 3.3.3.** Given consideration of subsurface conditions and the potential effects on the operating Siltronic facility, work completed by NW Natural and Siltronic confirms the feasibility of constructing the vertical barrier using sheet pile methodology. Based on this work, DEQ concurs with NW Natural's recommendation to construct the vertical barrier using sheet pile construction methods. DEQ defers to the NW Natural team's expertise in selecting steel sheets for the vertical barrier.

**Section 3.3.3.1.** DEQ concurs with NW Natural that no "substantial unresolved constructability issues" remain with regard to constructing the vertical barrier. Although DEQ identifies lack of provisions for controlling groundwater in the fill WBZ as a design deficiency, it is not considered a substantial issue. As discussed in our comments to Section 1.2, controlling groundwater flux in the fill must be achieved by NW Natural whether the barrier is constructed or not.

**Section 3.3.3.2.** Prior to initiating vertical barrier construction, DEQ will expect a work plan to be prepared detailing NW Natural's approach to temporarily by-passing and replacing the WR-107 outfall.

**Section 3.3.3.3.** As part of vertical barrier planning and design, DEQ required NW Natural to assess methods to minimize the potential for DNAPL to migrate vertically downward during construction. DEQ understands this design detail will be worked out further if a sheet pile barrier(s) is selected as a component of the final upland remedy.

**Section 3.3.4.** Contingencies should be discussed if the 4-foot bucket cannot remove debris encountered during pre-trenching (e.g., alternate equipment, trench re-alignment, etc.).

**Section 3.3.6.** NW Natural should provide additional information to clarify how joint sealing "prior to subsequent driving of a sheet pile pair" will be done. It is unclear how joint sealant remains in place while a new sheet is driven between an in-ground pair. It is also not clear how and to what extent joint sealant is forced into the joint void when the temporary sheet is removed.

**Section 4.1.1.** DEQ's comment to Section 1.2 regarding the fill WBZ zone applies here.

**Section 4.1.2.** DEQ's comments to Appendix C and the Pilot Study Report apply here.

**Section 4.1.3.** DEQ understands from reviewing this section of the Interim Design Report that:

- Maintenance of an individual extraction well, including replacing a pump, is expected to be completed within 24 hours.
- Power loss could reasonably shut-down the HC&C and groundwater treatment systems for up to 12 hours based on historic records from Portland General Electric.

Based on discussions with NW Natural during meetings, DEQ understood power losses up to between 24 to 36 hours could occur. NW Natural should check information provided in this section and explain the shorter timeframe, or confirm DEQ's understanding of the topic. In addition, given the uncertainty regarding the maintenance of extraction wells (see Section 4.2.2.3), NW Natural should evaluate a shut-down scenario involving extraction well replacement.

Besides extraction well shut-downs, the groundwater treatment system will be shut down for maintenance and in response to periodic high level/pressure shut-downs. NW Natural should provide additional information regarding the length of time associated with treatment system shut-downs (see also DEQ's comments to Appendix C).

NW Natural's approach to evaluating potential water quality impacts is also provided in this section of the report. The evaluation of the period of time the system could be shutdown before an unacceptable water quality impact in the river occurs appears to be more appropriate for planning an in-water capping project. As such, the approach pre-supposes implementation of in-water remedial action alternatives. Furthermore, the input parameters, model documentation, and results were not provided to DEQ for discussion or review prior to the Interim Design Report being submitted, and are not included in the document. For clarification, DEQ envisioned a simpler scenario being assessed. NW Natural should revise the response to estimate the time needed for contaminated groundwater to: 1) escape capture and bypass the HC&C system; and 2) migrate to the river in the event shut-down occurs. The estimated timeframes should then be compared to the shutdown times associated with power outages.

**Section 4.2.1.1.** DEQ's comment to Section 2.1.1 applies here. In the last paragraph, NW Natural indicates free cyanide was not detected in any surface water samples collected during the offshore investigation. It should be noted total cyanide was detected in three samples at concentrations ranging from 10 micrograms per liter (ug/L, or parts per billion) to 140 ug/L in surface water.

**Section 4.2.1.3.** DEQ acknowledges the Gradient Evaluation Report simulated reasonable worst-case scenarios for assessing groundwater flow rates to the river and sizing the groundwater treatment system. In general, NW Natural's interpretations regarding the results of groundwater modeling conducted near the shoreline focus on the effects extraction wells have on hydraulic gradients at or below the base of the vertical barrier, including interpretations #3, #4, and #6 listed in this section. However, information presented in the Interim Design Document continues to support DEQ's conclusion that locating extraction wells at or below the bottom of the vertical barrier increases vertical downward gradients behind the barrier and the potential for DNAPL to mobilize.

Figures 3-3a through 3-3c show model output for an extraction well screened between elevation -40 and -60 feet with the HC&C system pumping at a total discharge rate of 250 gpm, under three vertical barrier scenarios, including: 1) a barrier constructed to -40 feet (Figure 3-3a), 2) a barrier constructed to -60 feet (Figure 3-3b), and 3) no barrier (Figure 3-3c). Compared to ambient conditions (see Appendix I, Figure A-9), downward vertical gradients 15 to 20 feet above the top of the screen (elevation -20 to 25 feet) increase by factors between approximately 20 (no barrier) and 30 times (barrier constructed to elevation -60 feet). DEQ also notes that gaps in fine-grained material shown in cross-section (see Figure 2-3b) provide avenues for DNAPL to move downward in the alluvium. Furthermore, downward migration is further facilitated by the intermediate or neutral wettability of DNAPL occurring near the shoreline (i.e., capillary forces resisting movement are less).

Although pumping extraction wells cause hydraulic gradients to reverse from the river back towards the uplands, the information summarized above supports DEQ's conclusion that NW Natural's recommended approach to HC&C along the most impacted portion of Segment 1 has a high potential for inducing downward vertical migration of DNAPL.

Documentation for the groundwater model including general calibration, verification, and sensitivity, as well as specific recalibration of the model (referenced in the Interim Design Report) and the incorporation of the lower aquitard (presented for the first time in the Interim Design Report) is insufficient. For the final design document, NW Natural should provide more detailed documentation regarding numerical modeling, including its update and refinement for the Interim Design Report, as follows:

- A table describing hydrostratigraphic layers represented in the model and their dimensions compared to the characterization shown in cross-section using well log information.
- A water budget summary for the hydrostratigraphic layers represented in the model.
- Hydraulic properties assigned to the model layers including, but not limited to, calibrated vertical and horizontal hydraulic conductivities (Kv/Kh), specific storativity, and specific yield.
- Details on the numerical model boundaries.
- Additional calibration information demonstrating confidence in the model representing measured heads under various conditions. The available information[9] is insufficient to allow for a spatial evaluation, and modeled versus measured heads appear to be off calibration by up to four feet, or

[9] See Figure 4-5 NW Natural Gasco, Pump Test Analysis and MODFLOW Model Summary – October 2007

approximately 25% of the total average gradient across the site. Calibration plots should include a spatial plot of the head difference between modeled and measured values across the site to focus refinements to the hydraulic properties and model grid where needed. Additionally, time-series plots of seasonal water level data should be compared with transient modeled water levels trends to verify the model under measured seasonal variation.

- A sensitivity analysis to potential future land use changes (e.g. ditch/trench lining, removal, site paving) that could change the current recharge, gradient/flow conditions assumed by the numerical groundwater flow model.

NW Natural should be advised the existing model may have to be further modified to fully evaluate the performance and effectiveness of HC&C (e.g., vertical extent and timeframe of capture where fine-grained layers/lenses are present). Modifications may include but not be limited to, decreasing the grid spacing within selected portions of the model. Alternatively, project needs may indicate development of more detailed purpose specific models is warranted.

**Section 4.2.1.4.** NW Natural indicates that with regard to the modeling work done to assess the potential influence of pumping extraction wells on DNAPL movement that, "From this analysis, enhanced groundwater movement in the former effluent pond area due to shoreline extraction wells is minimal and would not substantially change DNAPL distribution over time." For clarification, DEQ understands the modeling work focused on assessing the additional component of DNAPL movement induced by extraction wells. Site investigations completed to date show that under unstressed conditions DNAPL in the alluvial WBZ has migrated laterally away from the former effluent ponds towards the river and vertically downward.

Based on information provided in the RI Report, the effluent ponds were used between 1941 and 1955. Using the midpoints of DNAPL occurrence shown in borings TG-8, B-4B, and GS-09; the distances between TG-8 and B-4B and TG-8 and GS-09; and the range of time bracketing pond use and submittal of the DNAPL mobility evaluation (i.e., 53 to 67 years); DEQ estimates horizontal and vertical DNAPL migration rates under non-pumping conditions range between 3.3 and 5.4 feet/year and 0.3 and 0.8 feet/year, respectively. Based on this information and literature[10] which indicates coal tar DNAPL can migrate for over 100 years before attaining a stable subsurface configuration, DEQ concludes DNAPL migration is ongoing. As such, the uplands FS should evaluate remedial action alternatives that mitigate DNAPL migration, including, but not necessarily limited to source reduction, removal, and stabilization.

**Section 4.2.2.1.1.** DEQ has a number of comments regarding this section of the Interim Design Report.

- For clarification, based on numerical simulations the final horizontal hydraulic conductivity of the upper and lower alluvial WBZs used for the MODFLOW model were 15 and 300 feet/day respectively.
- The vertical placements of extraction well screens are discussed in terms of their positions relative to the upper and lower alluvial WBZs. An additional significant factor for locating screened

[10] Gerhard, J.I.; Pang, T.; Kueper, B.H., 2007, "Time Scales of DNAPL Migration in Sandy Aquifers Examined via Numerical Simulation," Groundwater Vol. 45, No. 2, March–April 2007, pages 147–157.

intervals is the occurrence of DNAPL and dissolved phase contamination, neither of which is discussed here. NW Natural should provide additional information regarding the locations of the proposed extraction wells, screen depths, and the distribution of DNAPL and MGP and VOC contamination.

- NW Natural indicates extraction well PW-1 through PW-7 are planned to be screened in the upper alluvial WBZ. Within this group, the two PW-3 extraction wells are already constructed in the upper (PW-3-85) and lower (PW-3-118) alluvial WBZs. The vertical placement of PW-3-118 is inconsistent with NW Natural's location criteria described in this report section. The purpose and NW Natural's plans for operating PW-3-118 should be further explained.
- The vertical placement of the screen for extraction well PW-2 (elevation -25 to -45 feet) does not appear to coincide with the highest concentrations of total cyanide shown in Figure 2-12b. The location and vertical placements of the screens for extractions wells PW-1 and PW-2 should be compared to the distribution of MGP and VOC COI and adjusted as needed to intercept the highest concentrations of contaminants.
- Spacing of extraction wells decreases from approximately 200 feet to about 140 feet between PW-3-85/118, PW-4, and PW-5 behind the vertical barrier. The rational for tightening the spacing should be provided.

**Section 4.2.2.4.1.** This section outlines a proposed monitoring program to verify the performance of the HC&C system. The proposed network appears to be predicated on contemporaneous installation of the vertical barrier wall. Since DEQ accepted NW Natural's recommendation to defer the vertical barrier to the uplands FS, and HC&C along this section of Segment 1 is also going to be evaluated in the FS, NW Natural should revise the program for monitoring the performance of two groups of extraction wells, including 1) PW-1 and PW-2, and 2) PW-7 through PW-10. For example, piezometer cluster PZ7 should be relocated to monitor the influence of pumping extraction wells PW-1 and PW-2 on the Siltronic Property. DEQ notes between the MW-5 monitoring well cluster on the NW Natural Property and the WS-8/WS-12 cluster on the Siltronic Property there are no monitoring wells installed near the shoreline above 112 feet bgs. Additional monitoring wells should be installed to measure water levels and groundwater chemistry in closer proximity to extraction wells PW-1. The wells should be installed at depth intervals corresponding to the highest contaminant concentrations.

NW Natural indicates the goal of operating extraction wells is to maintain the average groundwater elevation below the average river elevation, initially on a running one-hour basis. However, the performance criterion for water level differences is not discussed and should be provided in NW Natural's response to this letter.

**Section 6.** DEQ acknowledges NW Natural's commitment to consider sequencing the vertical barrier early or first during upland remedial activities. DEQ would add that regardless of whether the vertical barrier is selected as a component of the final remedy, based on the magnitude of contamination and its proximity to the river, remedial action(s) in the southern portion of the NW Natural Property should be scheduled for early implementation.

**Table 2-2.** DEQ understands the lower aquitard occurs entirely within the lower alluvial WBZ. The title of the table implies the lower aquitard separates the upper alluvium from the "deep" alluvium. The title should be revised to indicate the table compares groundwater data collected above and below the lower aquitard.

**Table 4-4.** It is unclear why only four monitoring wells are shown for the Siltronic Property when there are eight that could be considered "shoreline" installations and a total of fourteen that should be considered for water level performance monitoring. NW Natural and Siltronic should select additional monitoring wells for purposes of monitoring water level data between and upgradient of extraction wells PW-1 and PW-2. The revised Table 4-4 should be included in the final design document.

**Figures – General Comment.** Inconsistencies between figures in the Interim Design Report make comparing, interpreting, and understanding related figures difficult. Examples are listed below.

- Certain figure reference the "NAVD 88," mean sea level, and City of Portland vertical datums. DEQ understands the datum in current general use is the COP datum. This should be made clear in the text and all relevant figures should be reviewed and revised as appropriate in the final design document.
- The vertical datum(s) used to prepare many figures is not referenced, including Figure 1-2, figures 2-2a through 2-2c; figures 2-3a through 2-3c; figures 2-5 through 2-7; and figures 2-12a, 2-12b, 2-13, 3-1, 3-4, 3-9, and 4-1. Furthermore, contours on Figure 3-4 are not labeled. NW Natural should review and revise any figure combining elevation information with site and/or investigatory information.
- The TarGOST® logging locations and geotechnical borings shown on Figure 2-1 are not included on figures 2-2a through 2-2c and should be added for reference and completeness. In addition, TG-4 is missing from Figure 2-3b.
- Geologic cross-sections reference shoreline source control segments 1 and 2 and show the locations of uplands installations, while subsurface profiles of free and total cyanide refer to the NW Natural and Siltronic property line and nearshore borings. Furthermore, monitoring wells, extraction wells, and geologic information are not provided on figures 2-12a and 2-12b. As such, evaluating the locations of the proposed extractions wells in the context of groundwater contamination, and the relationship between subsurface stratigraphy and contamination cannot be assessed.
- As shown by figures 2-3a through 2-3c, the vertical barrier and extraction wells are located in the uplands along or near a geologic cross-section containing uplands monitoring wells (see Figure 2-10). However, the subsurface distributions of free and total cyanide shown by figures 2-12a and 2-12b rely on interpretations of data collected from nearshore borings (GS-01 through GS-12) that are between 75 and 125 feet downgradient and under the river from where monitoring wells and extraction wells are located. These figures should be revised to show contaminant distributions interpreted from uplands monitoring wells in the final design document.
- The distribution of VOCs in groundwater is not shown in any figure in the Interim Design Report. Figures depicting the nature and extent of groundwater contamination are considered deficient lacking this information and should be revised accordingly.

The referenced figures should be reviewed and revised. Copies of the revised figures should be included in NW Natural's response to this letter and included in the final design document.

**Figures 2-3a through 2-3c.** DEQ notes water level information for the fill WBZ is representative of seasonal low values (i.e., conditions of low flux to the river). The figures should be revised to include a range of water levels for comparison purposes and completeness.

**Figures 2-3b, 2-3c, and 2-5 through 2-7.** These figures appear to rely on: 1) geologic observations made during the most recently completed geotechnical drilling and monitoring well installation work; and 2) DNAPL intervals identified during TarGOST® logging work. Regarding DNAPL occurrence at a number of monitoring well locations (e.g., WS-14), sheen observed during drilling preceded DNAPL entering the installation. As such, DEQ considers observations of sheen as being suggestive of the presence of DNAPL. The figures should be revised to include depths intervals where evidence of DNAPL (e.g., sheen, heavy sheen) was observed during all uplands drilling work completed in the areas shown in cross-section, including but not limited to borings B-29, B-55, B-57, B-58, B-59; boreholes at the MW-18, MW-19, WS-14, and WS-16 monitoring well clusters; and PW-01-80. Where DNAPL is shown for monitoring well locations, the depth of occurrence should also be checked. DEQ previously requested these figures be revised in the August 22nd Letter. The figures should be reviewed, revised, and resubmitted for the final design document.

**Figure 2-10.** Lacking groundwater data from monitoring wells, NW Natural should fill in the gap in groundwater data between the MW-5 and WS-8/WS-12 monitoring well clusters above elevation -75 feet with reconnaissance groundwater sampling data collected by either NW Natural and/or Siltronic. In addition, based on the detected concentrations of total and free cyanide between approximately 0 and -80 feet in elevation, the figure should have been extended beyond (i.e., upstream) of the WS-8/WS12 monitoring well clusters. Lastly, vinyl chloride should be added to the list of target analytes to provide information regarding the distribution of VOCs within the cross-section shown. The figure should be reviewed, revised, and resubmitted for the final design document.

**Figure 3-2c.** The title for the figure may be incorrect. DEQ understands the figure depicts the estimated extent of DNAPL "below" 100 feet bgs. The figure should be reviewed and revised as appropriate.

**Appendix A – Sheet Pile Design Report**

DEQ has a number of questions and comments regarding the wall design presented in this appendix as follows:

- General. The information presented presumes the vertical barrier is being constructed to elevation -40 feet. As indicated in DEQ's general comments the barrier carried forward into detailed analysis in the uplands FS should extend to elevation -60 feet. DEQ continues to understand this depth is feasible and the appendix could be revised by simply referencing the appropriate construction and materials depths (e.g., construct barrier to -60 feet; sheet pile lengths 80 feet long). NW Natural should confirm this understanding in the response to this letter.

- Pre-Trenching. NW Natural indicates the trench, "...will be dug to a depth not greater than the groundwater table or where the strata of oversized material and undisturbed natural material transition." DEQ considers it reasonable to plan for a scenario in which oversize material occurs below the water table, and wonders if dewatering has been, or should be considered during trenching.
- Groundwater. According to the Wall Depths section, the top of the barrier will be set at elevation +20 feet. Shallow groundwater is indicated as being at elevation +13 feet. As discussed above, DEQ considers the vertical barrier design to be incomplete without engineering controls to prevent groundwater in the fill WBZ from mounding behind and migrating around the barrier.
- Alignment. Additional information should be provided to clarify whether the stormwater pipe that needs to be reconnected is below the water table, acknowledge construction below the water table could require additional engineering controls during construction (e.g., dewatering; water storage, sampling, and management), and clarify whether the penetration through the wall needs to be sealed.
- Drawing SP1. Labels and text on the 11"x17" versions of the drawing are blacked out. The figure should be revised and resubmitted for insertion into the document copies. The ends of the vertical barrier shown in the drawing are either linear (north end) or exhibit a short-radius curvature towards the river (south end). NW Natural should discuss the need for typical landward facing end wingwalls to reduce the potential for dissolved phase constituents and/or NAPL from migrate around the ends of the barrier.

The report should include a section describing sheen monitoring in the river. The construction of SCMs or implementation of remedial action technologies (e.g., sheet-pile driving) could cause sheen bursts, blossoms, and/or outbreaks to occur in the river. As was done during the vibration study, a sorbent and containment boom system should be deployed to capture any sheen generated during uplands construction activities. Visual monitoring should be done throughout the work day and the boundaries of the boom system adjusted as needed to ensure sheen is captured.

**Appendix C, Water Treatment/Treatment System Pilot Study**

DEQ understands sludge and water produced during the treatment system pilot study were managed consistent with DEQ's March 27, 2008 letter regarding investigation derived waste. NW Natural should provide documentation regarding solids IDW management for DEQ's information and completeness. For the final design document, DEQ expects NW Natural to identify each waste-stream in the water treatment process and document the type of media (solid, liquid); regulatory status (solid waste, hazardous waste), basis for regulatory determination (e.g., regulatory citation, knowledge of process, sampling data), estimated annual volume, and anticipated management approach. Figures should be provided to clearly show the locations of waste-streams in the treatment process.

Comments regarding the water treatment system are listed below.

- The potential presence of unexpected DNAPL in the treatment system and the apparent reliance on manual draining of LNAPL from oil-water separators (OWSs) will require attention during operation. DEQ expects the schedule for OWS inspections and LNAPL/DNAPL removal criteria to be detailed in the final design document.

- Equalization storage volumes for the NW Natural and Siltronic treatment systems appear to underestimate capacity needs. Given DEQ's decision to defer installation of four extraction wells to the uplands FS and using a reasonable pumping rate of 25 gpm for each extraction well , influent into the Siltronic and NW Natural treatment systems is estimated to be 50 gpm and 100 gpm respectively. This translates into total daily influent volumes of 72,000 gallons (Siltronic) and 144,000 gallons (NW Natural). On an average daily basis equalization tank storage capacity represents between 7.5% and 15% of the total daily flow. NW Natural should check storage needs and provide additional information justifying equalization tank requirements in the context of this information. In addition, NW Natural should evaluate the length of time extraction wells can continually operate during treatment plant shut-downs.
- NW Natural should discuss the implications of specifying a 259 gpm clarifier feed pump given the overall treatment system is designed for maximum flow rates of 400 gpm.
- Page 10 of the appendix indicates the treatment system will use two GAC units in series, page 18 indicates a parallel arrangement, and sheet M-8 does not clearly depict the configuration. NW Natural should clarify.
- It does not appear DNAPL pumps (see Interim Design Report, Figure 4-4) are included in the extraction well design. Figures M-3 and M-4 do not identify this type of pump. NW Natural should clarify.

DEQ's review of the Pilot Study Report focused on final effluent data. DEQ understands analytical results collected from sampling locations NW-9 (Table 6) and NW-9S (Table 7) are representative of the final treated effluent data (i.e., data for treated effluent prior to discharge) from the NW Natural and Siltronic process streams respectively. Comments regarding the data compiled in tables 6 and 7 are provided below.

- DEQ's letter dated April 2, 2009 identified xylene as a monitoring parameter for the pilot study, however data for is reported as "m,p-xylene" and "o-xylene" in tables 6 and 7. NW Natural should explain these results further.
- The footnotes for tables 6 and 7 reference footnotes in attachments E and G. These references are confusing, especially for the chromium(VI) notes in Table 6. NW Natural should revise the tables to make the information more understandable and accessible, and resubmit them.
- Iron and manganese data are inconsistently reported in tables 6 and 7. NW Natural should clarify which iron and manganese data represent total or dissolved concentrations. NW Natural should also confirm concentration units. The tables in the Pilot Study Report should be reviewed and revised as appropriate.
- In addition to chromium(III) and chromium(VI), "chromium" is reported twice in Table 6 with different values. NW Natural should clarify chromium data and confirm concentration units. The tables should be reviewed and revised as appropriate.
- The maximum values for several parameters are elevated in Table 6. Certain parameters exceed the applicable water quality standard (WQS), including arsenic , copper, iron, lead, manganese, mercury, nickel, benzo(a)pyrene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, and tetrachloroethene. NW Natural should confirm DEQ's observations of the data and indicate how these results were considered in treatment system design.

- Several parameters shown in Table 6 have quantitation limits greater than the values listed in DEQ's November 2007 technical memorandum[11], including cadmium, chromium(VI), tetrachloroethene, trichloroethene, toluene, and ethylbenzene. Except for toluene and ethylbenzene, the higher quantitation limits could impact reasonable potential. NW Natural should confirm DEQ's observations of the data and indicate how these results were considered in treatment system design.
- The maximum values for several parameters in Table 7 are elevated, including iron, mercury, and manganese. The value for iron exceeds the WQS. The maximum values for manganese and mercury are just below or at the WQS, respectively. NW Natural should confirm DEQ's observations of the data and indicate how these results were considered in treatment system design.
- Several parameters shown in Table 7 have quantitation limits greater than the values listed in DEQ's November 2007 memorandum, including cadmium and chromium(III). The higher quantitation limit for chromium (III) will likely not impact reasonable potential; however the limit shown for cadmium (1.00 ug/L) could have an impact.

NW Natural should address DEQ's comments regarding the treatment system and Pilot Study Report in the response to this letter. The clarifying information and revised versions of table 6 and 7 are needed before DEQ can proceed with updating the Reasonable Potential Analysis using the pilot study effluent data.

**Appendix D, Geotechnical Boring Logs and Soil Data Tables**

DEQ has the following specific comments regarding Figure A-1 (Key to Exploration Logs) and the geotechnical boring logs in the appendix.

- The date water levels were observed during drilling are not shown on the logs.
- The test symbol "GS" is not included on Figure A-1.

Table 1 includes a column for "Permeability" testing in which no values are provided. NW Natural should clarify whether testing results should be included in the column, or confirm all testing results are provided in Table 2 as "Hydraulic Conductivity" values.

**Appendix E, Well Design**

Consistent with work done previously, the plan specifies that pumping and observation wells be constructed with 0.035-inch V-shaped wire-wrapped screen. Graded 10-20 Colorado Silica sand will be used for the filter pack material around the well screens. The manufacturer's maximum recommended slot size opening for this gradation of filter pack material is 0.030. As such, the use of 0.035-inch slots may allow passage of some of the filter pack material. Well construction procedures should ensure that: 1) thorough surging of the well during filter pack placement is conducted, and 2) upon completion of surging the top of the filter pack be verified and brought back to the specified level prior to placement of the annular seal.

[11] DEQ, 2007, "Addendum to Reasonable Potential IMD to Revise Quantitation Limits," November 16, a document prepared by DEQ.

In the interest of reducing the potential influence of DNAPL, sheen, and/or contaminated groundwater on future observation or monitoring well construction, DEQ recommends NW Natural modify installation procedures as follows:

- Bailing contaminated fluids out of the upper casing (i.e., larger casing) used to double-case the borehole(s). Where subsurface require the use of double-case drilling methods, this step should be performed immediately after the upper casing is seated in the bentonite plug, and just before the secondary casing is placed downhole. DEQ acknowledges potable water may be needed to stabilize water levels in the casing, but considers this preferable to carrying contaminated fluids down the borehole.
- Using fine graded sand on top of the screen filter pack as pouring bentonite chips through heavy sheen or DNAPL could hinder hydration. Fine graded sand does not require hydration and can prevent migration of the bentonite and organoclay slurry into the filter pack.

These comments should be incorporated into the final design document. In addition, the final design document should provide details for managing investigation derived waste consistent with procedures currently in place and being used by NW Natural or Siltronic.

**Appendix F, Sampling and Analysis Plan**

If NW Natural has not already done so, comments made by EPA and DEQ to the Segment 2 Test Plan[12] should be fully incorporated into the appendix for the final design document.

**Table F-1.** DEQ has the following clarifying comments regarding the sampling parameters list provided in the table.

- Chemical monitoring should include, but is not limited to, analyzing groundwater samples from extraction wells and/or performance monitoring wells for:
  - Typical field measured water quality parameters;
  - NW Natural and Siltronic facility COI (e.g., polycyclic aromatic hydrocarbons; VOCs, metals);
  - All parameters on the groundwater treatment system discharge list, and any additional constituents that could influence extraction well and/or groundwater treatment system operation and performance.
- The analyte list should be revised to include 1,2,4-trimethylbenze and 1,3,5-trimethylbenzene under the appropriate suite of analyses.
- A performance objective of the HC&C system is to reverse groundwater gradients and induce movement of water from the river towards extraction wells. Inorganic indicator parameters of river water should be added to the analyte list to monitor progress towards meeting this objective, including, but not necessarily limited to, calcium, potassium, sodium, iron (total and dissolved), magnesium (total and dissolved), sulfate, chloride, bicarbonate, carbonate, and nitrate.

[12] Anchor QEA, LLC, 2009, "Capture Zone Field Test Plan – Gasco, Portland, Oregon," September, a work plan prepared for NW Natural.

**NEXT STEPS**

DEQ is not requiring the Interim Design Report to be revised and resubmitted. Within 30 days of receiving this letter, NW Natural should provide a written response to DEQ's comments and requests for information and/or clarifications. Copies of all revised figures should be submitted within 45 days of NW Natural's receipt of the letter. DEQ recommends a meeting be arranged as soon as practicable after NW Natural reviews this letter to discuss the scope, content, and schedule for the final source control design document.

Please feel free to contact me with questions regarding this letter.

Sincerely,

Dana Bayuk
Project Manager
Portland Harbor Section

Cc: Patty Dost, Pearl Legal Group
John Edwards, Anchor QEA
Carl Stivers, Anchor QEA
Rob Ede, Hahn & Associates
Myron Burr, Siltronic Corporation
Tom McCue, Siltronic Corporation
Alan Gladstone, Davis Rothwell Earle and Xochihua
James Peale, Maul Foster & Alongi, Inc.
Ted Wall, Maul Foster & Alongi, Inc.
Kristine Koch, EPA
Sean Sheldrake, EPA
Lance Peterson, CDM
Jim Anderson, NWR/PHS
Rob Burkhart, NWR/WQ
Tom Gainer, NWR/PHS
Henning Larsen, NWR/SRS
Matt McClincy, NWR/PHS
ECSI No. 84 File
ECSI No. 183 File

NWN/206
Witness: Robert Wyatt

# BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

## UG 263

## NW NATURAL

**Exhibit Accompanying Direct Testimony of Robert Wyatt**

**Letter Dated August 9, 2012, from DEQ**

**October 2013**

Oregon
John A. Kitzhaber, MD, Governor

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August 9, 2012

*Also Sent Via E-mail*

Robert J. Wyatt
NW Natural
220 N.W. Second Avenue
Portland, OR 97209

Re: **Revised Groundwater Source Control Measures Construction Design Report**
**Shoreline Segments 1 and 2, NW Natural Property and the Northern Portion of the Siltronic Corporation Property**
**Portland, Oregon**
**ECSI Nos. 84 and 183**

Dear Mr. Wyatt:

The Oregon Department of Environmental Quality (DEQ) reviewed the Revised Groundwater Source Control Construction Design Report[1] (Construction Design Report). In addition, DEQ reviewed NW Natural's November 4, 2011 responses to our September 22, 2011 comments on the Revised Groundwater Source Control Interim Design Report[2] (Revised Interim Design Report). NW Natural's November 4th responses document the changes made to the Construction Design Report. Anchor QEA, LLC prepared the Construction Design Report and the November 4th responses for NW Natural.

The primary purpose of this letter is to:

- Reply to NW Natural's November 4th responses to our September 22nd comments on the Revised Interim Design Report;
- Convey DEQ's comments on the Construction Design Report;
- Inform NW Natural that after the results of the final extraction well design steps are submitted to DEQ and following our review and approval, the overall final design of the Alluvium water-bearing zone (WBZ) hydraulic control and containment (HC&C) system will be complete and construction can proceed. The final extraction well design steps include:
  - Updating the groundwater model and using it to evaluate the HC&C system operating under two reasonable worst-case scenarios representative of seasonal ranges in site-specific groundwater conditions; and
  - Finalizing the designs of the remaining upper Alluvium WBZ extraction wells.
- Notify NW Natural that DEQ approves the control wells, piezometers, observation wells, and monitoring wells included in the groundwater source control performance monitoring network subject to our replies to NW Natural's November 4th responses and comments to the Construction Design Report, including:
  - Adding two piezometers (PZ7-100 and PZ9-110) to the network;
  - Constructing observation wells in the Fill WBZ so the bottom of the screened intervals are located at the top of the upper silt unit;

[1] Anchor QEA, LLC, 2012, "Revised Groundwater Source Control Construction Design Report, NW Natural Gasco Site," January (received January 31, 2012), a report prepared for NW Natural.
[2] Anchor QEA, LLC, 2011, "Draft Groundwater Source Control Final Design Report, NW Natural Gasco Site," May (received May 9, 2011), a report prepared on behalf of NW Natural (recognized by DEQ as the equivalent of the Revised Groundwater Source Control Interim Design Report).

- Equipping monitoring wells WS-8-33, WS-8-59, and WS-12-161 with transducers to assess the limits of the hydraulic influence of the Alluvium WBZ hydraulic control and containment (HC&C) system to the southeast;
- Placing downhole temperature and specific conductance probes in piezometers in the PZ2 and PZ8 clusters and the upper three piezometers in the PZ-7 and PZ9 clusters; and
- Providing documentation on the applicability of the pre-packed monitoring well sump seals for use at the site.

The final extraction well design steps are discussed further under DEQ's comments on the "Well Design Work Plan" and our reply to NW Natural's "Category 1, Comment 12, Section 1.3" response. Subsequent to providing written confirmation that DEQ's modifications to the performance monitoring network are accepted and providing the requested information, NW Natural can proceed with constructing the control wells, piezometers, observation wells, and monitoring wells in Construction Design Report as modified.

The U.S. Environmental Protection Agency (EPA) also reviewed the Construction Design Report and those comments were transmitted by DEQ to NW Natural on July 18, 2012 (see attached). In addition, EPA reviewed this letter and agrees with DEQ on the final extraction well design steps, DEQ's approval of the performance monitoring network as modified above, and the path forward for constructing, testing, and documenting HC&C system construction and installation of the performance monitoring network. Furthermore, EPA informed DEQ that this letter captures their Construction Design Report comments sent July 18th. Consequently, EPA will not expect NW Natural to respond separately to those comments.

This letter also provides a brief background on groundwater source control and the status of the ongoing groundwater source control measures (SCMs) final design and construction process. The letter focuses on the SCMs design work done following submittal of the Revised Interim Design Report. DEQ's September 22, 2011 letter summarizes the overall SCMs planning and design process prior to submittal of that document and should be referred to for additional details and information on this subject.

## BACKGROUND

NW Natural is moving forward with final design of groundwater SCMs along the shorelines of the "Gasco" site and the northern portion of the adjoining property owned by Siltronic Corporation (i.e., shoreline segments 1 and 2). Groundwater in the Fill WBZ and the Alluvium WBZ along segments 1 and 2 have been identified as high-priority pathways of contamination from the uplands to the Willamette River that warrant source control. Groundwater source control involves preventing groundwater contamination in the Fill WBZ and the Alluvium WBZ from migrating to the Willamette River, and not mobilizing manufactured gas plant (MGP) dense non-aqueous phase liquids (DNAPLs) where they occur along Segment 1. The principal elements of groundwater source control include; 1) a fully penetrating interceptor trench in the Fill WBZ; 2) a well-based HC&C system for the Alluvium WBZ; 3) a groundwater and DNAPL performance monitoring network and sampling and analytical program to evaluate the operation and performance of the HC&C system; and 4) a water treatment system.

## GROUNDWATER SOURCE CONTROL MEASURES DESIGN AND CONSTRUCTION FRAMEWORK

NW Natural prepared the Construction Design Report consistent with the "Framework" for finalizing the design and constructing the HC&C system for the Alluvium WBZ. NW Natural introduced the

Framework during a meeting on October 5, 2011 and proposed the Framework in writing in a letter dated November 4, 2011. The November 4th letter also responds to DEQ's September 22, 2011 comments on the Revised Interim Design Report. The Framework proposes breaking the draft final groundwater SCMs design report discussed throughout DEQ's September 22, 2011 comments letter, into three separate HC&C system design documents. The three HC&C system design documents include the following:

- A Revised Treatment System Design which finalizes the design of the water treatment system.
- A Revised Groundwater Source Control Construction Design Report that finalizes the design of the Alluvial WBZ HC&C system and responds to DEQ's September 22nd comments related to design and construction of the HC&C system.
- A Groundwater Source Control Operations and Performance Monitoring Design Report (Operations Design Report) that will present the results of transient groundwater modeling work; development and selection of HC&C system operational parameters and performance criteria; and recommendations for implementing contingencies measures.

DEQ accepted the Framework for completing the designs and constructing the groundwater treatment system and HC&C system as modified by our letter dated December 7, 2011. Consistent with our December 7th letter, the Framework for completing the HC&C system design and construction elements consists of five general steps to be completed in the following sequence:

- Step 1 – NW Natural submits and DEQ reviews and provides comments on the Revised Treatment System Design[3]
- Step 2 – NW Natural submits and DEQ reviews and approves the Construction Design Report and NW Natural constructs HC&C system
- Step 3 – NW Natural conducts initial full-scale HC&C system operation and testing
- Step 4 – NW Natural submits and DEQ reviews and approves the Operations Design Report
- Step 5 –NW Natural operates HC&C system full-time subsequent to receiving the final individual NPDES permit for the treatment system (i.e., NW Natural and Siltronic pre-treatment facilities and main treatment plant).

The December 7th letter should be referred to for additional information and details on DEQ's decisions regarding the Framework, each of the steps listed above, and planning, designing, and constructing groundwater SCMs, including the Fill WBZ interceptor trench. The Framework agreed to between NW Natural and DEQ is intended to achieve construction and the initial operation/testing of the HC&C system (i.e., Step 2 and Step 3) by the end of 2012.

Framework Status

DEQ considers Step 1 of the framework to be essentially complete. For purposes of project scheduling, NW Natural requested DEQ's review comments on the Revised Treatment System Design by April 2, 2012 to facilitate ordering long-lead treatment equipment. DEQ provided comments on the design document in a letter dated April 5, 2012 that also included EPA's comments as an attachment. The reviews completed by EPA and DEQ did not identify issues that would prevent NW Natural from ordering long-lead equipment, which DEQ understands is proceeding. DEQ is currently reviewing NW Natural's May 25, 2012 response to our April 5th letter.

[3] Sevenson Environmental Services, Inc., 2012, "NW Natural and Siltronic Wastewater Treatment Final Design Report," January (received January 31, 2012 as Appendix E to the Construction Design Report), a report prepared for NW Natural.

Step 2 of the framework for finalizing design and constructing the HC&C system and conducting baseline DNAPL and groundwater monitoring is ongoing. On behalf of NW Natural, Anchor submitted the following work plans concurrently with the Construction Design Report that provide additional details about the work items to be completed under Step 2:

- "Upper Alluvium Extraction Well Design Work Plan, NW Natural Gasco Site, Portland, Oregon" dated January 31, 2012 (Well Design Work Plan); and
- "Work Plan to Assess Baseline Groundwater Conditions, NW Natural Gasco Site, Portland, Oregon" dated January 31, 2012 (Baseline Monitoring Work Plan).

DEQ's perspective on the status of the work items identified in both work plans is provided below.

**Well Design Work Plan**

The Well Design Work Plan provides additional technical information for completing the work described in Section 3.2.2.2.1 (Well Location and Screen Depth) and Section 3.2.2.2.2 (Well Materials, Construction, and Development) of the Construction Design Report. In addition, the work plan applies to Appendix K (Well Construction and Development Plan). The Well Design Work Plan identifies the work items and the sequence of work agreed to by NW Natural and DEQ to finalize design of the upper Alluvium WBZ extraction wells.

The Well Design Work Plan consists of seven work items, or tasks. The status of each task is summarized below.

Task 1 – Compile Existing Specific Capacity Data and Well Efficiency Information: This task is complete. Table 3-2 of the Construction Design Report provides this information. DEQ requests the table be updated with new information as it becomes available during future extraction well drilling, installation, and step-drawdown testing.

Task 2 – Conduct Push Probes at Each Upper Alluvium Extraction Well Location to Obtain Soil Samples from the Projected Screen Zones: This task is complete. Push-probe drilling and material sampling occurred at the locations of upper Alluvium WBZ extraction wells PW-1U, PW-2U, PW-3U, PW-4U, PW-5U, PW-6U, PW-11U, PW-12U, PW-13U, and PW-14U. Grain-size analyses have been performed on samples as approved by DEQ.

Task 3 – Design Well Screen and Annular Backfill from the Grain-size Data: This task remains to be completed. Based on grain-size tests completed under Task 2, NW Natural recommended and DEQ approved the use of 20-slot wire-wrapped stainless steel screen and filter packs consisting of 16x30 graded-sand for use at extraction wells PW-2U, PW-3U, PW-5U, and PW-6U. DEQ understands the results of the grain-size tests and NW Natural's recommendations for constructing the remaining upper Alluvium WBZ extraction wells will be submitted to DEQ for review and approval in the near future.

Task 4 - Install Four of the Upper Alluvium Extraction Wells: This task is complete. Construction, development, and step-drawdown testing of upper Alluvium extraction wells PW-2U, PW-3U, PW-5U, and PW-6U are complete.

Task 5 – Install Upper Alluvium Monitoring Wells: DEQ considers this task to be complete. For clarification, the Well Design Work Plan called for installing monitoring wells MW-35U, MW-33U, MW-37U, and MW-26U to measure water levels during step-drawdown testing at extraction wells PW-

2U, PW-3U, PW-5U, and PW-6U respectively. Given questions regarding the details of monitoring well construction and in the interest of moving the HC&C system final design process forward, DEQ proposed and NW Natural accepted an alternative approach. The alternative relied on using existing monitoring wells and installing purpose-specific piezometers to monitor water levels during step-drawdown testing. Monitoring wells MW-35U, MW-33U, MW-37U, and MW-26U are components of the groundwater SCMs performance monitoring network which DEQ approves subject to conditions listed above.

Task 6 – Conduct Step-drawdown Tests at Each of the Four New Upper Alluvium Extraction Wells: This task is complete. Step-drawdown testing of upper Alluvium WBZ extraction wells PW-2U, PW-3U, PW-5U, and PW-6U was completed shortly after each well was installed. Based on the initial test results indicating unexpectedly low specific capacities, these extraction wells were redeveloped and retested along with extraction wells PW-8-38 and PW-9-92. Redevelopment measurably increased the capacities of the referenced extraction wells.

Task 7 – Incorporate the New Data into the MODFLOW Model: This task remains to be completed. The task includes NW Natural: 1) providing the results of step-drawdown tests to EPA and DEQ for review; 2) incorporating step-drawdown test results and EPA/DEQ comments on groundwater modeling into the site MODFLOW model; and 3) using the updated MODFLOW model to; a) confirm that previous simulations of the HC&C system operating under a reasonable worst-case site scenario of maximum groundwater flux remain valid; and b) evaluate the long-term operation of the HC&C system under a reasonable worst-case site scenario of minimum available drawdown for the upper Alluvium WBZ extraction wells.

The work completed to date has been done consistent with the Well Design Work Plan and with DEQ's approval. Task 3 will be complete subsequent to DEQ's review and approval of NW Natural's recommendations for constructing upper Alluvium WBZ extraction wells PW-1U, PW-4U, PW-11U, PW-12U, PW-13U, and PW-14U. Regarding Task 7, DEQ issued our comments on the MODFLOW model and modeling work, along with EPA's comments on the Construction Design Report by e-mail on July 18, 2012. For completeness, DEQ's July 18th e-mail is attached to this letter. NW Natural submitted the step-drawdown data package to DEQ for review on August 1, 2012. Subsequent to DEQ's review and approval of the step-drawdown data for use in the MODFLOW model (Task 7, Item #2), the modeling work performed using the updated MODFLOW model (Task 7, Item #3a,b), and the designs of PW-1U, PW-4U, PW-11U, PW-12U, PW-13U, and PW-14U (Task 3), the overall final design of the HC&C system will be complete and Step 3 of the Framework will proceed, including HC&C system construction and initial operation/testing.

**Baseline Groundwater Work Plan**

The Baseline Monitoring Work Plan corresponds to certain portions of Section 3.2.2.5 (Performance Monitoring) of the Construction Design Report. The work plan also applies to Appendix M (TarGOST® DNAPL Boring Procedures) and Appendix O (Sampling and Analysis Plan). The work plan identifies the work items agreed to between NW Natural and DEQ to establish baseline conditions for the occurrence of DNAPLs and groundwater chemistry prior to starting up the HC&C system on a full-time basis. Baseline data will be used to assess potential DNAPL mobilization and monitor groundwater chemistry trends after the system is operating full-time. The Baseline Monitoring Work Plan should be referred to for additional information about each of the work items.

The Baseline Groundwater Work Plan consists of four tasks; the status of each is summarized below.

Task 1 – Baseline DNAPL Mobilization Monitoring TarGOST® Borings: This task remains to be completed. This letter provides DEQ's comments on the Construction Design Report relevant to this work item (i.e., Section 3.2.2.5.3; Appendix M) and our replies to NW Natural's responses to the September 22, 2011 letter commenting on the Revised Interim Design Report (see DEQ's reply to "Category 1, Comment 21, Section 3.2.2.5.3, Targost Sampling").

Task 2 – Baseline DNAPL Mobilization Monitoring TarGOST® Borings: This task is complete except as indicated by DEQ. Consistent with the Baseline Monitoring Work Plan and with DEQ's approval, NW Natural completed the baseline TarGOST® borings at extraction well locations PW-2U, PW-3U, PW-5U, PW-6U, and 14U. That said, observations made during push-probe drilling at the remaining upper Alluvium WBZ extraction well locations indicate TarGOST® logging should also be conducted at the PW-11U location prior to the initial operation and testing of the HC&C system.

Task 3 – Baseline Monitoring of DNAPL Entering Extraction Wells, Monitoring Wells, and Piezometers: This task remains to be completed. The list of extraction wells, the proposed installations in the performance monitoring network, and the DNAPL monitoring frequency are provided in Table 3-5 of the Construction Design Report. As shown by Table 3-5 and consistent with the current DEQ-approved monitoring programs for the Gasco and Siltronic sites, DNAPL measurements are being conducted on an ongoing basis at many existing installations which are also included in the performance monitoring network. That said, the goals and objectives of baseline DNAPL monitoring will not be met until the extraction wells, control wells, piezometers, observation wells, and monitoring wells are drilled and constructed, and DNAPL measurements are made according to the Construction Design Report as modified by DEQ's comments. This letter identifies the final design steps for extraction wells. This letter also provides DEQ's approval to install the control wells, piezometers, observation wells, and monitoring wells in the performance monitoring network subject to the comments provided in this letter. DEQ's clarifying comments on the DNAPL monitoring frequency are provided below (see DEQ's replies to "Category 1, Comment 21, Section 3.2.2.5.3, Monitoring and Recovery of DNAPL Entering Wells" and "Category 1, Comment 22 and Comment 23, Section 3.2.2.5.4, DEQ's Specific Comments, pages 11 and 12").

Task 4 – Baseline Water Quality Monitoring: This task remains to be completed. Table 3-5 of the Construction Design Report lists the piezometers, observation wells, and monitoring wells proposed for the performance monitoring program and the sampling frequency. As shown by Table 3-5 and consistent with the current DEQ-approved monitoring programs for the Gasco and Siltronic sites, groundwater chemistry is being monitored on an ongoing basis at many existing installations which are also included in the performance monitoring network. However, the goals and objectives of baseline groundwater monitoring will not be met until additional piezometers, observation wells, and monitoring wells are drilled and constructed, and sampling and analysis are performed according to the Construction Design Report. This letter provides DEQ's approval to install the control wells, piezometers, observation wells, and monitoring wells in the performance monitoring network subject to the comments provided in this letter. DEQ's clarifying comments on the performance monitoring program are provided below (see DEQ's replies to "Category 1, Comment 22 and Comment 23, Section 3.2.2.5.4, DEQ's Specific Comments, pages 11 and 12").

DEQ's comments on the DNAPL and groundwater performance monitoring program, including the numbers, locations, and depths of installations; the monitoring frequency; and the plan for collecting samples for laboratory analysis, are provided below. DEQ comments are organized consistent with NW

Natural's November 4, 2011 response and the relevant sections of the Construction Design Report. As indicated above, DEQ approves the performance monitoring network and monitoring program subject to the comments provided in this letter.

Fill WBZ Interceptor Trench

DEQ notes the agreed-to Framework focuses on designing and constructing the Alluvium WBZ HC&C system. Regarding the Fill WBZ interceptor trench, in the interest of completing the Construction Design Report and constructing the HC&C system in 2012, DEQ agreed to allow NW Natural and Siltronic to initiate trench construction after the HC&C system is in-place. DEQ's current position on the length and alignment of the trench, and sequence and schedule of trench construction remain the same as communicated to NW Natural and Siltronic in our September 22, 2011 letter commenting on the Revised Interim Design Report and in our December 7, 2011 letter. DEQ continues to request initiation of trench construction within: 1) six months of completing the initial phase of HC&C system operation/testing (i.e., within six months of completing Step 3), or 2) no later than six months after initiating full-time operation of the HC&C system (i.e., within six months of completing Step 5). DEQ's September 22nd and December 7th letters should be referred to for additional information on our position.

Consistent with agreements made between NW Natural and DEQ, Appendix J of the Construction Design Report includes NW Natural's proposed interceptor trench approach provided in the Revised Interim Design Report as a placeholder for the work to be performed in the future. Future work will include a geotechnical investigation to evaluate the trench alignment described in our September 22nd letter, and finalizing trench construction methods. The Construction Design Report indicates that, "Immediately following submittal of the revised OPDR [i.e., Operations Design Report], NW Natural will submit a work plan for a geotechnical investigation, designed to determine the feasibility of relocating the interceptor trench or constructing the trench in sections, as suggested by DEQ." Consistent with DEQ's comments regarding the length of the trench, the scope of the geotechnical investigation should extend along the property line between the Gasco and U.S. Moorings sites and beyond the WS-8 monitoring well cluster on the Siltronic property.

## NW NATURAL'S NOVEMBER 4, 2011 RESPONSES TO DEQ'S SEPTEMBER 22, 2011 COMMENTS ON THE REVISED INTERIM DESIGN REPORT

NW Natural responded to DEQ's September 22, 2011 comments on the Revised Interim Design Report in a letter dated November 4, 2011. The November 4th response letter forms the basis for preparing the Construction Design Report in the context of the Framework. Attachment B of the November 4, 2011 letter organizes NW Natural's responses into three general categories. One category (Category 1) is intended to identify DEQ comments that NW Natural understands are related to design and construction of the Alluvium WBZ HC&C system. The second category is based on NW Natural's understanding that DEQ's comments involve additional evaluations of post-construction operation and performance (Category 2). A third category of responses (Category 3) identifies DEQ comments that NW Natural is not prepared to agree with and which require additional discussion with DEQ.

DEQ's replies to NW Natural's November 4, 2011 response letter are provided below. For clarification, DEQ has not replied to NW Natural's responses regarding Fill WBZ interceptor trench, the Treatment System Design, and/or the MODLOW model and groundwater modeling. DEQ's comments and/or replies on these topics have previously been provided in letters dated September 22, 2011 and December 7, 2011 (Fill WBZ interceptor trench) and April 5, 2012 (Treatment System Design), and the July 18, 2012 e-mail (MODFLOW model and modeling work).

General Comments

**Groundwater SCMs Remedial Action Objectives.** NW Natural indicates in the November 4, 2011 response that DEQ's September 22, 2011 general comment on source control remedial action objective (RAOs) would be addressed in the Construction Design Report (see Category 1, Comment 1). DEQ's September 22nd letter indicates that after dispute resolution the focus of source control is the groundwater pathway. Furthermore, DEQ clarifies that the objectives for groundwater source control are to prevent migration of contaminated groundwater from the uplands to the Willamette River along shoreline segments 1 and 2 in a manner that minimizes DNAPL mobilization resulting from operating groundwater SCMs along the portion of Segment 1 where DNAPL occurs. DEQ understands from the last paragraph of Section 1.2 that NW Natural agrees with these SCMs objectives. Furthermore, DEQ understands and accepts that NW Natural will be using the results of the initial operations and testing phase to develop and select HC&C system operational parameters and performance criteria that achieve these objectives. Operational parameters and performance criteria will be presented in the Operations Design Report.

Consistent with agreements reached between NW Natural and DEQ, evaluations of DNAPL remedial alternatives will be conducted in the uplands FS. Remedial alternatives evaluations will include, but are not be limited to, the vertical barrier NW Natural recommended in the DNAPL/Groundwater FFS[4] (i.e., the SCM recommended to physically prevent DNAPL from migrating to the river).

DEQ notes that Sections 1.1 and 1.2 of the Construction Design Report provide a general overview of the background of the source control planning and design process, including development of groundwater source control objectives. DEQ believes sections 1.1 and 1.2 do not adequately document available information on the development of groundwater SCMs objectives, including the objectives that came out of the December 2011 dispute settlement. The section of DEQ's September 22, 2011 letter summarizing the SCMs planning and design process and development of RAOs, should be referred to for additional details and information on this subject.

**HC&C System Operations and Performance Criteria.** Many of NW Natural's Category 1 and Category 2 responses recommend selecting HC&C system operational and performance criteria based on "transient" groundwater modeling. NW Natural proposes performing transient modeling following construction and initial testing of the HC&C system and during preparation of the Operations Design Report. DEQ approved NW Natural's transient modeling proposal in the July 18, 2012 e-mail transmitting our comments on Appendix F (Model Documents) of the Construction Design Report. In addition, DEQ acknowledges and accepts NW Natural's proposal to develop and select specific operational parameters (e.g., ΔH value, limits on extraction well pumping rates) and performance criteria (e.g., horizontal and vertical gradients needed to minimize DNAPL mobilization while hydraulically controlling and containing groundwater in the Alluvium WBZ) based on the data collected during initial operations/testing of the HC&C system. However, DEQ does not approve constructing the HC&C system without additional information on how the information needed to develop and select operational parameters and performance criteria will be indentified and evaluated.

The general approach to conducting initial operations and testing phase of the HC&C system is described in Section 3.2.2 of the Construction Design Report. DEQ requests that NW Natural supplement Section 3.2.3 with information that:

[4] Anchor QEA, LLC, 2007, "Groundwater/DNAPL Source Control Focused Feasibility Study – NW Natural 'Gasco' Site," October 12 (amended November 9th), and report prepared for NW Natural.

- Identifies sources of uncertainty associated with the data to be collected during the initial operations/testing phase and used for purposes of developing and selecting HC&C system operational parameters and performance criteria, and
- Describes how the uncertainties will be addressed or evaluated during testing.

As indicated in DEQ's general comments to the Revised Interim Design Report, NW Natural's presumption that during Segment 2 pilot well tests groundwater level changes and gradient changes observed between pre-pumping and pumping periods were due entirely to the influence of extraction wells could lead to overestimating the effectiveness of the HC&C system. DEQ's request is intended to address this comment by identifying potential factors unrelated to the extraction wells and evaluating their potential influence during the initial operations/testing. Processes that influence water level measurements (e.g., measurement error in transducers and electronic water level sensors) and/or cause water level fluctuations (e.g., river stage fluctuations, river stage changes) represent sources of uncertainty for data collection during initial testing.

DEQ believes identifying sources of uncertainty and developing approaches for evaluating them during testing will focus data collection objectives relevant to long-term HC&C system operations and is necessary for the initial operations/testing phase to be successful.

Specific Comments

DEQ's replies to NW Natural's November 4, 2011 Category 1 responses are provided below.

**Category 1, Comment 3, General Comments, Page 9, Uplands Source Control and the In-water Sediment Remedy (also Category 2, Comment 3).** NW Natural's response to this comment is not acceptable. DEQ requested NW Natural to evaluate how the long-term sediment remedy objective of reversing gradients from the river to the uplands will be reconciled with the source control objective of minimizing DNAPL movement. DEQ also requested clarification from NW Natural on the operational priorities of the HC&C system in the context of the in-water remedy. NW Natural's response indicates DEQ's comments would be addressed in the Construction Design Report. However, the information DEQ requested does not appear to be included in the document. DEQ requests NW Natural to indicate where in the Construction Design Report the comment is addressed, or provide the requested information and evaluations in the Operations Design Report.

**Category 1, Comment 4, General Comments, pages 9 and 10, Performance Monitoring, Monitoring Well Network.** DEQ's replies to NW Natural's November 4, 2011 responses are provided below.

1st bullet, Page 11. Section 3.2.2.5.1 of the Construction Design Report addresses DEQ's comments requesting descriptions of the data collection objectives of the performance monitoring well network.

2nd bullet, Page 11. Table 3-5 addresses DEQ's comment requesting the data collection objectives be identified for piezometers, observation wells, and monitoring wells in the performance monitoring well network.

3rd bullet, Page 11. Table 3-5 addresses DEQ's comment requesting identification of the data collection objectives for each monitoring well.

4th bullet, page 11. NW Natural's response is not acceptable. DEQ's general comment on evaluation HC&C system operational parameters and performance criteria applies here.

1st bullet, page 12. DEQ's comment is addressed by NW Natural agreeing to abandon monitoring well MW-17-79 and installing MW-38U.

2nd bullet, page 12. DEQ's comment regarding installing a control well in the upper Alluvium WBZ between extraction wells PW-5U and PW-14U is addressed by NW Natural agreeing to install monitoring well MW-37U.

3rd bullet page 12. DEQ's comment regarding installing monitoring wells in the lower portion of the upper Alluvium WBZ at the locations of extractions wells PW-11U, PW-12U, PW-13U, and PW-14U is addressed by NW Natural agreeing to install monitoring wells MW-34U, MW-31U, MW-28U, and MW-27U respectively.

DEQ's request for the new monitoring wells referenced to be equipped with transducers is also addressed. As shown by Table 3-5, the news wells will either be set-up as control wells or with transducers to collect water level data.

**Category 1, Comment 5, General Comments, page 10, DNAPL Monitoring.** DEQ's replies to NW Natural's response are provided below.

1st bullet on page 13 and page 14. DEQ's comment is addressed by the figures provided in Appendix Q of the Construction Design Report, which have been revised to show observations of sheen. DEQ requests NW Natural to update figures 2-3 through 2-8 of the Construction Design Report with information as it becomes available during push-probe drilling performed to support extraction well designs.

2nd bullet, page 14. NW Natural's response is not acceptable. DEQ's general comment on evaluation HC&C system operational parameters and performance criteria applies here.

3rd bullet, page 14. As discussed above, DEQ approved baseline TarGOST® borings near the locations of extraction wells PW-02U/L, PW-03U/85/118, PW-05U/L, PW-06U/L, and PW-14U via an e-mail sent April 13, 2012. This work is complete. Based on push-probe drilling work completed since that time, TarGOST® logging should also be conducted at the PW-11U location prior to the extraction well being installed.

**Category 1, Comment 12, Section 1.1.** DEQ acknowledges that consistent with our comment NW Natural included copies of DEQ's August 9, 2010 and October 27, 2010 letters in Appendix B. To fully address our comment, a copy of the requested January 3, 2011 e-mail is attached to this letter for completeness and for NW Natural's information. Copies of the January 3rd e-mail should be included in future submittals as appropriate.

**Category 1, Comment 12, Section 1.3.** NW Natural did not respond to DEQ's comment indicating extraction wells should be constructed so as not to restrict uplands remedial actions (e.g., excavation removal). Extraction wells are located in the vicinity of additional SCMs (e.g., Fill WBZ interceptor trench) and/or remedial actions (e.g., riverbank removal, replacement, stabilization; sheet-pile vertical barrier) that will or could be constructed along the same length of shoreline. Consequently, there is the potential for future construction work to compromise the installations. DEQ recommends constructing

the wells to increase their structural stability (e.g., completing extraction wells with oversized large-diameter concrete seals which extend through the fill into the upper Alluvium). This is an item requiring resolution before extraction wells are constructed. NW Natural should be advised measures may need to be taken to protect existing extraction wells during construction to prevent damage.

**Category 1, Comment 13, Section 2.1.4, 2nd paragraph.** NW Natural's response is not acceptable without additional supporting information. The Construction Design Report indicates NW Natural further reviewed the evidence of DNAPL detected with ultraviolet (UV) light at Boring GS-09. Based on the additional review, except for UV light other evidence of DNAPL was not observed (e.g., sheen, tar, or oil were not visually observed). Consequently, NW Natural believes the previously reported occurrence of DNAPL at the GS-09 location at elevation -25-feet results from UV light reacting with naturally occurring material in sediment (i.e., UV light detections are not related to MGP contamination). DEQ requests additional information to support NW Natural's conclusions, including but not limited to documentation that UV light sources detect naturally occurring material and the types of material, and observations made at the site and/or sampling and analytical results which show UV light detections are not related to MGP contamination.

Regarding the occurrence of DNAPL at depth in Boring GS-09, DEQ would remind NW Natural of our previous comments on the GS-series borings and DNAPL migration from the uplands to the river. DEQ previously indicated in our March 26, 2010 comments to the Interim Design Report that the twelve GS-series are too few and spaced to far apart (approximately 200 feet apart) to make determinations regarding DNAPL migration from the uplands to under the river. DEQ requests this issue be incorporated into the uplands FS scoping and planning process.

**Category 1, Comment 13, Section 2.1.4, 2nd paragraph.** NW Natural's response is acceptable. DEQ's request for uplands cross-sections showing groundwater chemistry data for benzene, naphthalene, toluene, cis-1,2-dichloroethene, vinyl chloride, total cyanide, and free cyanide is addressed by figures 2-11a, 2-11b, and 2-11c.

**Category 1, Comment 13, Section 3.1.1.** DEQ's general comment regarding groundwater source control objectives applies here.

**Category 1, Comment 13, Section 3.1.1.1, last paragraph (NOTE...comment may apply to the last paragraph of Section 3.2.1.1).** NW Naturals response is acceptable. DEQ requested NW Natural to acknowledge detections of total cyanide in the Willamette River. The Construction Design Report now indicates dissolved total cyanide was detected in at least four samples at concentrations ranging from less than 10 to 140 micrograms per liter (µg/L, or parts per billion).

**Category 1, Comment 14, Section 3.1.3.** NW Natural response is not acceptable as it does not address DEQ's comment. The Construction Design Report indicates that, "When a well is shut down for maintenance, the system will automatically increase the pumping rate on the adjacent wells to maintain capture." DEQ's comment expresses concern that increasing flow rates during maintenance or replacement of an extraction well could cause excessive drawdown in the upper Alluvium WBZ extraction well(s) and/or increase mobilization of DNAPL. DEQ requests this scenario be further evaluated during preparation of the Operations Design Report.

**Category 1, Comment 14, Section 3.1.3, last paragraph page 14.** NW Natural's response is acceptable. DEQ requested information regarding the capacity of the treatment system backup generators to operate during floods. The Construction Design Report now indicates, "...the treatment plant and

backup power system are designed to operate under flood conditions up to the elevation of the 100- year flood event, if necessary."

**Category 1, Comment 14, Section 3.2.1.1, 6th paragraph.** NW Natural's response is not acceptable as it appears to be incomplete. DEQ acknowledges the source control sampling plan has been revised to include total, available, and free cyanide. DEQ also notes that NW Natural's response agrees to run laboratory splits on selected available cyanide samples. However, DEQ's request for laboratory splits does not appear to be included in the Construction Design Report. Consistent with our September 22, 2011 comment, split sampling should be conducted and coordinated with DEQ.

**Category 1, Comment 16, Section 3.2.1.6, 4th paragraph.** DEQ's comment is addressed by the figures provided in Appendix Q of the Construction Design Report. DEQ requests NW Natural to update figures 2-3 through 2-8 of the Construction Design Report with information as it becomes available during drilling performed to support extraction well designs.

**Category 1, Comment 17, Section 3.2.1.7.** NW Natural requests a meeting to discuss how DEQ's DNAPL wettability and transport rate comment(s) should be used for designing the performance monitoring program. For clarification, the comment was intended to communicate DEQ's disagreement with NW Natural's assertion that estimates of DNAPL travel are, "...conservative approximations of the potential distances that DNAPL could travel, and the true estimate would be less if the capillary term was factored into the calculation." As indicated in our September 22, 2011 comment and previous correspondence, the MGP DNAPL near the shoreline exhibits intermediate or neutral wettability. Consequently, the affect of capillary forces on DNAPL transport is reduced or limited. DEQ continues to believe observations and measurements of DNAPL occurrence under the former Tar Ponds Area provide a sound technical basis for estimating transport rates. Using this information, DNAPL mobility is likely greater than the "conservative" estimates NW Natural discusses in this section of the Construction Design Report and presents in Table 3-3. DEQ believes this information highlights the importance of including potential DNAPL movement in the evaluation and selection of HC&C system operational parameters and performance criteria. DEQ is available to meet if NW Natural considers further discussions of this topic are needed.

**Category 1, Comment 17, Section 3.2.1.8.** NW Natural's response requests DEQ to clarify our reference to additional information in the June 9, 2009 and March 26, 2010 letters. Respectively, the June 9, 2009 and March 26, 2010 letters provide additional background information and context for DEQ's: 1) approval of NW Natural's proposal to implement DNAPL removal after construction of the HC&C system and vertical barrier; and 2) acceptance of NW Natural's recommendations to defer evaluations of DNAPL removal and the vertical barrier to the uplands FS.

**Category 1, Comment 19, Section 3.2.2.2.1, 2nd paragraph page 30 (also Category 2, Comment 11).** NW Natural's response is acceptable. DEQ accepts NW Natural's recommendation to evaluate the need for extraction wells PW-9U and PW-10U based on the initial operation/testing of the HC&C system. In addition to evaluating the addition of PW-9U and PW-10U to the HC&C system, DEQ requests the results of the initial operation/testing phase be used to conduct a full review of contingency measures that should be implemented before full-scale full-time operation of the HC&C system proceeds. DEQ further requests the list of contingency measures include adding groundwater extraction wells and/or installations for DNAPL removal, increasing or decreasing groundwater extraction rates, lowering submersible pumps into extraction well sumps, and adding DNAPL removal pumps to extraction wells. The Operations Design Report should address both of DEQ's requests.

**Category 1, Comment 19, Section 3.2.2.2.1, last paragraph.** NW Natural's response is acceptable. DEQ understands from Section 3.2.2.2.1 of the Construction Design Report that screen intervals were adjusted on figures 2-3a through 2-3c to avoid fine-grained layers where feasible while maintaining a consistent elevation between extraction wells. DEQ requests the objective of avoiding crossing fine-grained layers to be carried forward during drilling and installation of the remaining extraction wells. In other words, the final depth interval for the screen will be based on observations made during drilling at that location, and avoiding crossing fine-grained layers will be a factor in selecting the actual screen depth interval.

**Category 1, Comment 19, Section 3.2.2.2.2, 1st paragraph.** NW Natural's November 4, 2011 response and the Construction Design Report, including the Framework, address DEQ's comment that requested the following information be provided:

1. Rational for changing the diameters of extraction wells from 8-inch to 6-inch;
2. Evaluations of specific capacity and well efficiency information available from previous extraction well tests; and
3. Acknowledgment that screen slot sizes and filter pack material will be selected for each of the upper Alluvium WBZ extraction wells based on sieve analyses conducted on material collected from the screen intervals.

NW Natural's response combined with the additional details provided in the first paragraph of Section 3.2.2.2.2 address Item #1. Item #2 is addressed by Table 3-2 of the Construction Design Report and the final design step involving modeling the minimum available drawdown scenario. Regarding Item #2, DEQ expects previous comments regarding the HC&C system flow rates required to maintain negative $\Delta H$ values through river and tidal stages will be addressed by the initial phase of HC&C operation/testing and the transient groundwater modeling to follow. In addition, future submittals that use specific capacity to estimate drawdowns and/or pumping rates at extraction wells (see Table 3-4a and Table 3-4b), should make it clear that specific capacity values are not constant and decline with increasing flow rates. The Framework approach to selecting screen slot sizes and filter pack material for upper Alluvium WBZ extraction wells (e.g., PW-2U, PW-3U, PW-5U, and PW-6U) based on sieve analyses, and the recently completed redevelopment work completed at extraction wells PW-2U, PW-3U, PW-5U, PW-6U, PW-8-38, and PW-9-92 address Item #3.

Besides the three items listed above DEQ believes the recently completed extraction well redevelopment work determined the root cause of poor well efficiency in certain extraction wells (e.g., PW-9-92). Consequently, the text in Section 3.2.2.2.2 of the Construction Design Report discussing screen slot size, sand pack material, and well efficiency should be revised or removed for purposes of preparing future documents.

**Category 1, Comment 19, Section 3.2.2.2.2, 2nd paragraph.** NW Natural response regarding the use of DNAPL funnels is acceptable. NW Natural will equip installations with DNAPL funnels. DEQ's comments regarding sealing around the sumps of extraction wells, monitoring wells, and/or observation well sumps were addressed prior to constructing upper Alluvium extraction wells PW-2U, PW-3U, PW-5U, and PW-6U. The approach developed for these four wells establish the protocol for sealing the sumps around extraction wells in the HC&C system. The sealing method is approved by the Oregon Water Resources Department (WRD) and DEQ for the project and involves the following general steps: 1) drilling to the bottom depth of the borehole using roto-sonic equipment and 10-inch diameter tools; 2) placing bentonite chips in the 10-inch casing over the depth interval of the sump; 3) allowing the chips to hydrate for approximately 30 minutes; 4) extracting a "plug" of the bentonite chip seal using 6-inch roto-sonic tools; and 5) inserting the extraction well sump into the void created by removal of the bentonite

**Category 1, Comment 24, Figures 3-7a and 3-7b.** NW Natural's response is acceptable. Consistent with DEQ's comment, the "Well Flange – Top" details on figures 3-9a and 3-9b (formerly figures 3-7a and 3-7b) in the Construction Design Report have been modified to indicate the 1-inch diameter transducer tube will be used to deliver Aqua Gard treatment media downhole.

**Category 1, Comment 27, Appendix K, Section 3.** NW Natural's response is acceptable. Consistent with DEQ's comment, turbidity will be monitored during observation/monitoring well development and the goal for development is to reduce turbidity to a value less than 50 NTU.

**Category 1, Comment 27, Appendix K, Section 4.** NW Natural's response to DEQ's comments about managing soil and groundwater investigation-derived waste is acceptable. NW Natural should note that DEQ's reply to "Comment 28, Appendix O, Section 4" applies here. NW Natural's response requests information on the status of the Special Waste Management Plan (SWMP) and the opportunity to review the draft document. For clarification, the SWMP is prepared by the originator of the material to be disposed and the receiving facility. The jointly prepared document is reviewed by DEQ.

**Category 1, Comment 28, Appendix O, Section 3.1.** NW Natural's response regarding turbidity is acceptable, however, the response to DEQ's request for additional details about sample collection is incomplete. Consistent with DEQ's comment, NW Natural will monitor turbidity during observation/monitoring well sampling and the goal for development is to reduce turbidity to a value less than 50 NTU. Regarding sample collection, the current groundwater monitoring program includes collecting and analyzing selected samples for dissolved metals analysis to compare with the total metals results. Although Section 3.2.2.3.4 of the Construction Design Report mentions that dissolved metals are included in the performance monitoring program, Appendix O does not provide information regarding how dissolved metals samples will be collected and/or handled. Furthermore, there is no information provided in the appendix regarding extraction well and/or outfall sampling. Appendix O should be revised accordingly. DEQ believes the final approved performance monitoring program will likely be incorporated into an HC&C system operations manual. If this is the case, Appendix O should make this clear.

**Category 1, Comment 28, Appendix O, Section 4.1.** NW Natural's response is acceptable. Section 3.1 has been revised to clarify that dedicated tubing or piping will be installed in all wells for use with sample collection pumps. A dedicated bailer will only be used to collect samples in the event of pump failure.

**Category 1, Comment 28, Appendix O, Section 5.3.2.1.3.** NW Natural's response is acceptable. The sampling and analysis plan has been revised to indicate that ice used to cool samples during transport to the laboratory will be sealed in durable plastic bags and that upon receipt the laboratory will measure the temperature of the cooler.

**Category 1, Comment 28, Appendix O, Section 5.3.2.1.4.** NW Natural's response is not acceptable. DEQ requested confirmation that field quality assurance samples will be collected on a daily basis during sampling events. Although NW Natural agreed to add this clarification, the appendix does not appear to have been revised. The clarification should be added to address DEQ's comment and for completeness.

**Category 3, Comment 1.** DEQ considers NW Natural's comments regarding potential delays to implementing the HC&C system to be unwarranted. DEQ is working with NW Natural with the goal of constructing the HC&C system before the end of 2012. DEQ acknowledges and agrees with NW Natural's comment about completing the uplands risk assessment as soon as possible so the uplands FS can be initiated.

Category 3, Comment 2. NW Natural expresses concern here that DEQ may require the U.S. Moorings site to be included in the groundwater SCMs being designed and implemented on the Gasco Site. In addition, NW Natural indicates that the site characterization associated with this work would cause unacceptable delays in implementing groundwater source control on the Gasco Site. DEQ acknowledges NW Natural's concerns, but does not agree considering U.S. Moorings in the design and/or construction of groundwater SCMs will delay source control implementation.

NW Natural has committed to achieving groundwater source control along shoreline segments 1 and 2. To determine groundwater source control is being achieved for the Alluvium WBZ, NW Natural will monitor and fully evaluate the extent and effectiveness of groundwater capture resulting from operating the HC&C system, including in the northern portion of the Gasco Site. The information provided by NW Natural in the Construction Design Report indicates the HC&C system will capture groundwater in the upper Alluvium WBZ beneath the southern portion of the U.S. Moorings site (see figures 3-2a and 3-2b). Consequently, NW Natural's evaluations of HC&C system performance and effectiveness will include the southern portion of the U.S. Moorings site.

As discussed in previous correspondence and this letter, work for the Fill WBZ interceptor trench will be conducted after the HC&C system is constructed. NW Natural proposes to prepare and submit a work plan for a geotechnical investigation to evaluate DEQ's requests for the trench length and alignment. This letter indicates the scope of the geotechnical investigation should include the northern portion of the Gasco Site along the property line with U.S. Moorings. Including the area along the property line in the geotechnical investigation and subsequent interceptor trench evaluations will achieve source control of the Fill WBZ sooner than postponing the work to be done separately at a later time.

Category 3, Comment 3. DEQ disagrees with NW Natural's entire comment and stands by our position on the Fill WBZ interceptor trench communicated in the September 22, 2011 letter commenting on the Revised Interim Design Report, the December 7, 2011 letter on the Framework, and this letter.

Category 3, Comment 4. DEQ acknowledges NW Natural's concerns regarding our request to include visual observations of sheen on cross-sections as evidence of DNAPL. The basis for DEQ's request is explained in previous correspondence, most recently in our September 22, 2011 letter commenting on the Revised Interim Design Report. As DEQ communicated to NW Natural previously, DNAPL mobilization is a significant factor for selecting the operational parameters and performance criteria for the HC&C system. In addition, DNAPL movement is an important element for monitoring HC&C system performance. Regarding sheen, DEQ disagrees with NW Natural on whether sheen is evidence of DNAPL. By definition, petroleum sheen is a thin layer of non-aqueous phase liquid present on the surface of water. In the Alluvium WBZ, DEQ considers observations of sheen to be evidence of DNAPL. Furthermore, depending on subsurface conditions and location specific considerations, the appearance of sheen could be used as a line of evidence for DNAPL migration. The purpose of the baseline DNAPL monitoring work is to establish an initial set of conditions that will be used to assess future observations and make informed decisions regarding the observations. For example, depending on previous DNAPL monitoring results and the location specifics of the installation, the appearance of sheen could be used to trigger changes in the DNAPL monitoring frequency or the schedule for conducting Targost® logging. DEQ believes this topic warrants further discussion and the approach for handling sheen observations should be presented in the Operations Design Report.

CONSTRUCTION DESIGN REPORT

In addition to replying to NW Natural's November 4, 2011 response to our September 22, 2011 comments on the Revised Interim Design Report Report, DEQ has comments on the Construction Design Report which are provided below.

**Section 1.4.** NW Natural provides the general timeframe for implementing groundwater SCMs in this section of the Construction Design Report. In addition, a general overview of the process for completing the uplands Risk Assessment and Feasibility Study (FS), and remedy design and implementation is described. DEQ would add that consistent with agreements reached between NW Natural and DEQ, the hot spot determination for the uplands is going to be conducted separately from the Risk Assessment. The results of the hot spot determination will be fully incorporated into any FS scoping and planning document.

**Section 2.1.3.** As DEQ indicated in our comments to the Revised Interim Design Report, depending on location the Fill WBZ consists of fill material made up of varying proportions of MGP waste, including spent oxide material, lampblack, carbon pitch, tar, and/or oil. Future submittals containing descriptions of the fill and/or the Fill WBZ should include this information.

**Section 3.2.1.1.** NW Natural continues to indicate DEQ required a series of investigations to be conducted in the Willamette River to, "...determine the nature and extent of contamination in offshore groundwater and river sediments." As indicated in previous correspondence, including our comments to the Revised Interim Design Report, although DEQ did oversee the in-water work referenced by NW Natural and documented in the Offshore Investigation Report[5], our primary interest was in assessing ongoing uplands contaminant transport pathways as sources of contamination to the river and river sediments. This data was incorporated into the Groundwater/DNAPL FFS and the SCMs planning and design process. The objective of a significant amount of the work performed during the offshore investigation was supporting the Portland Harbor in-water RI/FS being performed by the Lower Willamette Group under EPA's oversight. Furthermore, offshore investigatory work supplied surface water, sediment, transition zone water, and shallow groundwater data to assist planning of the in-water sediment project also being overseen by EPA. Future descriptions of these offshore investigations should include this information.

**Section 3.2.1.4.** NW Natural continues to indicate the groundwater modeling done using March 27, 2000 water level data "...represents a reasonable worst-case condition based on water level data." As indicated in previous correspondence including our comments to the Revised Interim Design Report, the simulations calibrated to the March 2000 water level data are considered to be representative of a reasonable worst-case scenario where groundwater extraction rates and treatment system flow rates are concerned (i.e., representative of a specific scenario). The simulations were used to further evaluate the potential maximum total extraction rate and total treatment flow rate of the HC&C system and treatment system respectively. NW Natural should make this clear in future submittals as not doing so could result in people with less familiarity of the project misunderstanding the purpose of the referenced modeling work.

**Section 3.2.1.6.** The Construction Design Report indicates that during the initial Targost® logging work completed in 2007 and 2008, DNAPL was defined to, "...include tar, mobile oil, and residual oil." DEQ

[5] Anchor QEA, LLC, 2008, "Offshore Investigation Report - NW Natural 'Gasco' Site," February, a report prepared for NW Natural.

considers the definition to be invalid based on the current understandings of the nature of MGP wastes on the NW Natural and Siltronic properties. For clarification, DEQ does not consider tar or oil present at residual levels to be DNAPL. Although tar can be considered a highly viscous liquid, from the standpoint of mobility tar in the Fill WBZ is essentially immobile under prevailing temperatures in the subsurface. DEQ considers oil at residual levels in the Fill WBZ and Alluvium WBZ to be potentially mobile as coalescence and movement could occur in response to changes in subsurface hydraulic conditions (e.g., increase in hydraulic gradient). DEQ's March 26, 2010 letter commenting on the Interim Design Report[6] also discusses the relative mobility and occurrence of tar and oil and DNAPL.

DEQ comments on the Interim Design Report and the Revised Interim Design Report previously addressed NW Natural's assertion that the TarGOST® technology, "...is reliable for the detection of the presence of tar and oil, but cannot differentiate between tar and oil or determine if the material is mobile." Consistent with previous correspondence, DEQ disagrees with NW Natural's description of the technology as it ignores site-specific considerations. Based on the material properties of MGP waste and the subsurface geology at the Gasco and Siltronic sites, DEQ considers the Targost® technology to be a reliable method for identifying mobile DNAPL in the alluvium (i.e., below the top of the upper silt unit). In other words, identification of MGP waste in the alluvium with the Targost® equipment reliably indicates DNAPL (i.e., oil) migrated to those depth intervals. In future submittals NW Natural should revise this sentence to read as follows:

> "Based on site-specific considerations, the technology is reliable for detecting the presence of tar and DNAPL in the fill. Positive responses by the Targost® probe in the alluvium reliably indicate the presence of DNAPL (i.e., oil) that has migrated to those depth intervals. However, the Targost® technology cannot determine whether DNAPL in the alluvium has reached a stable subsurface configuration (i.e., stopped moving) based on a single logging event."

This comment also applies to Appendix M (Targost® DNAPL Boring Procedures).

In addition, the first three sentences in the third paragraph of this section should be revised in future submittals to be consistent with the referenced figures as follows:

> "Figure 3-6a shows the nature and extent of tar and DNAPL in the fill. Figure 3-6b shows the areal extent of DNAPL in the alluvium above the depth of 100 feet bgs. Figure 3-6c shows the areal extent of DNAPL in the alluvium below 100 feet bgs."

**Section 3.2.2.5.2, Capture Assessment.** During a meeting and conference call on November 30, 2011, EPA and DEQ requested additional analysis and supporting information on the concept NW Natural proposes for hydraulic containment of the deep Alluvium WBZ (i.e., alluvium beneath the truncated deeper aquitard). Due to the nature of the alluvium and the gradients caused by the HC&C system compared to the river, NW Natural predicts that groundwater in the deep Alluvium WBZ will be drawn to extraction wells. NW Natural provided supporting information in the April 12, 2012 supplement[7] to Appendix F of the Construction Design Report. Based on the information provided in the April 12th Supplement, DEQ preliminarily accepted NW Natural's proposed concept for containment.

Consistent with DEQ's December 7, 2011 letter on the Framework, NW Natural's proposed concept will also be demonstrated using field data collected from existing and/or proposed installations. DEQ

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[6] Anchor QEA, LLC, 2009, "Groundwater Source Control Interim Design Report, NW Natural Gasco Site," November (received November 10, 2009), a report prepared on behalf of NW Natural.
[7] Anchor QEA, LLC, 2012, "NW Natural Gasco site: Documentation of Groundwater Model Modifications Since 2008," April 12, a memorandum prepared for NW Natural.

understands NW Natural added piezometer PZ6-115 to the performance monitoring network for this purpose. DEQ approves construction of PZ6-115, but concludes two more installations are warranted to assess the concept across Segment 1. DEQ requests piezometers be installed at an approximate elevation of -100 at the PZ7 cluster (PZ7-100) and -110 feet at the PZ-9 cluster (PZ9-110)

In addition, to requesting additional piezometers, DEQ has the following comments on the performance monitoring network and data collection and presentation.

- Head distribution maps and/or drawdown figures should be used to illustrate the influence of the HC&C system on water levels in the upper Alluvium.
- Measurement of heads within extraction wells is not ideal for evaluating hydraulic containment due to well inefficiencies. Consistent with EPA guidance, NW Natural should identify wells or install additional wells or piezometers near extraction points to more accurately represent groundwater elevations within the aquifer. Alternatively, NW Natural should explain how water levels at extraction wells will be predicted using the MODFLOW model and discuss the uncertainties and limitations on using the model for that purpose.
- In general, observation wells constructed in the Fill WBZ should be completed so the bottom of the screened interval is located at the top of the upper silt unit. Based on DEQ's review of figures 2-3a, 2-3b, and 2-3c, the depths of completion for observation wells OW-1-F, OW-5F, and OW-10-F should be adjusted upward or downward as appropriate to meet this objective.
- Table 3-5 should be revised to indicate monitoring wells WS-8-33, WS-8-59, and WS-12-161 will be equipped with transducers to assess the southern limits of the hydraulic influence of the HC&C system.
- NW Natural proposes to maintain an inward hydraulic gradient based on 3-day averages. This implies that inward gradients will not be constantly maintained throughout the 3-day periods. DEQ considers 3-day averages to be adequate for determining hydraulic control/containment in the uplands. However, this is not the case under the river where groundwater and sediment contamination extend along the entire flow path. Consequently, the potential exists for contaminant loading and sediment recontamination to occur to some extent each time an outward gradient reestablishes itself.
- In addition to using particle-tracking to depict capture zones at multiple depth intervals, NW Natural should develop vertical gradient contour maps to support evaluation of hydraulic control/containment along representative cross-sections.

DEQ notes that first two bulleted items are relevant to presenting data in support of the final design step and future evaluations of HC&C system performance. The third and fourth bulleted items are relevant to constructing installations in the performance monitoring network and collecting data for performance monitoring. The last two bulleted items are more relevant to the Operations Design Report.

Section 3.2.3. DEQ's general comment on operational parameters and performance criteria apply here.

Section 4. The Construction Design Report continues to indicate NW Natural submitted the application for an NPDES permit in February 2011. As indicated in DEQ's September 22, 2011 comments letter, the the application was not complete until the Land-Use Compatibility statement was received by DEQ in May 2011. This information should be incorporated into future submittals.

Figure 5-1. The schedules shown in the Construction Design Report (see Figure 5-1) and attached to the Well Design Work Plan indicate the Operations Design Report will be submitted in late March 2013. The schedule does not appear to include a line item for the interceptor trench geotechnical investigation work

plan. For clarification, DEQ requests the geotechnical investigation work plan to be submitted within the same timeframe as the Operations Design Report. In addition, the schedule should include a line item for submitting a "construction completion report" which DEQ requests under "Next Steps" in lieu of submitting a revised version of the Construction Design Report.

**Appendix K, Section 1.** The appendix should be revised to indicate that drilling and well installation will occur on the NW Natural and Siltronic properties and that where the location of underground utilities is uncertain, "NW Natural or Siltronic representatives" will pre-approve the drilling location. In addition, as DEQ has indicated previously, where rote-sonic equipment is concerned the drilling method does not typically provide "cores" of subsurface material (i.e., intact undisturbed samples over the drilled interval). Considerable disturbance occurs during drilling, removal of the material from the casing, and bagging the material.

**Appendix K, Section 2.1.** NW Natural should revise this appendix consistent with the methods, procedures, and protocols DEQ approved under the Framework and used for upper Alluvium extraction wells PW-2U, PW-3U, PW-5U, and PW-6U, including selecting well screen and sand pack material, constructing extraction wells, including sealing the sump; and developing screen intervals.

**Appendix O, Section 4.** NW Natural's response is not acceptable. The Sampling and Analysis Plan should be revised to include the information regarding managing investigation-derived waste (IDW) provided in Section 4 and Section 4.2 of Appendix K, including indicating that:

> "After the work is complete and analytical results are received, residual soils and liquids will be evaluated for disposal method consistent with Oregon Department of Environmental Quality (DEQ) regulations and procedures currently in place and being used by NW Natural and Siltronic."

Consistent with our September 22, 2011 comments on the Revised Interim Design Report, the IDW management procedures currently being used by NW Natural and Siltronic are laid-out in DEQ's March 27, 2008 and April 8, 2010 letters. NW Natural should be advised the procedures currently in-place may be modified or replaced by the final CMMP developed for the HC&C system, treatment system, and performance monitoring program.

## NEXT STEPS

DEQ believes this letter combined with our April 5, 2012 comments on the Treatment System Design, our September 22, 2011 and December 7, 2011 comments on the Fill WBZ interceptor trench, and the July 18, 2012 e-mail providing comments on the MODFLOW model and ongoing modeling work, completes our review and reply to NW Natural's November 4, 2011 response and provides our comments on the Construction Design Report. Furthermore, based on our involvement in reviewing and approving each task in the Well Design Work Plan, DEQ concludes NW Natural has substantially addressed comments regarding designing and constructing extraction wells. Subsequent to completing and submitting the final extraction well design steps and following DEQ's review and approval, NW Natural should move forward with constructing the HC&C system. DEQ approves installation of the control wells, piezometers, observation wells, and monitoring wells in the performance monitoring network as presented in the Construction Design Report and as modified by this letter.

For clarification, given the Framework for completing the designs of the treatment system, HC&C system, and performance monitoring network, DEQ is not requesting the Construction Design Report to be revised and resubmitted. That said NW Natural should prepare a report documenting the actual

completed construction of the HC&C system and performance monitoring network. This construction completion report should be submitted to DEQ within the same timeframe as the Operations Design Report.

Please feel free to contact me with questions regarding this letter.

Sincerely,

Dana Bayuk
Project Manager
Portland Harbor Section

Attachments: DEQ's July 18, 2012 e-mail
NW Natural January 3, 2011 e-mail

Cc: Patty Dost, Pearl Legal Group
John Edwards, Anchor QEA
Ben Hung, Anchor QEA
John Renda, Anchor QEA
Carl Stivers, Anchor QEA
Rob Ede, Hahn & Associates
Myron Burr, Siltronic Corporation
Tom McCue, Siltronic Corporation
Alan Gladstone, Davis Rothwell Earle and Xochihua
James Peale, Maul Foster & Alongi, Inc.
Ted Wall, Maul Foster & Alongi, Inc.
Christine Budai, ACOE
Mark Ader, EPA
Chip Humphrey, EPA
Kristine Koch, EPA
Sean Sheldrake, EPA
Lance Peterson, CDM
Scott Coffey, CDM
Jim Anderson, NWR/PHS
Rob Burkhart, NWR/WQ
Tom Gainer, NWR/PHS
Henning Larsen, NWR/SRS
Matt McClincy, NWR/PHS
ECSI No. 84 File
ECSI No. 183 File

BAYUK Dana

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|---|---|
| From: | BAYUK Dana |
| Sent: | Wednesday, July 18, 2012 4:01 PM |
| To: | John Edwards |
| Cc: | Ben Hung; John Renda; Michael Riley; Carl Stivers (cstivers@anchorqea.com); 'Sean Sheldrake'; 'Peterson, Lance'; Coffey, Scott; GAINER Tom; LARSEN Henning |
| Subject: | NW Natural, DEQ's Construction Design Groundwater Modeling Comments |
| Attachments: | GASCO_revised CDR Comments_with Appendix F comments_4-May-12.docx; DEQ_Modeling_Comments-Nov4_Responses&CDR_AppF-18Jul12.docx |

Hello John.

DEQ completed our review of Appendix F (Groundwater Model Documents) of the Construction Design Report (see footnote #1). DEQ's review included the supplement titled, "NW Natural Gasco Site: Documentation of Groundwater Model Modifications Since 2008" dated April 12, 2012 (April 12th Memorandum). DEQ's comments on the April 12th Memorandum are attached to this e-mail.

The attachment also replies to NW Natural's November 4, 2011 responses to DEQ's groundwater modeling comments included in our September 22, 2011 letter commenting on the Revised Interim Design Report (see footnote #2).

In addition to DEQ's comments on groundwater modeling, EPA's comments on the overall Construction Design Report, including Appendix F, are attached.

As Anchor requested during our meeting on July 2, 2012, DEQ is providing comments on groundwater modeling to facilitate Anchor's modifications and updates to the MODLOW model currently being used to support the final design of the Alluvium WBZ HC&C system. DEQ understands from the July 2nd meeting, updating the MODFLOW model is a current priority for Anchor.

For your information, DEQ is preparing a letter commenting on the design of the groundwater source control performance monitoring program proposed in the Construction Design Report, including the numbers, locations, and depths of monitoring wells and piezometers in the program. This letter will provide DEQ's perspective on the overall status of the "Framework" for finalizing the design of the Alluvium WBZ HC&C system and performance monitoring program.

As you know, NW Natural proposed the 5-step Framework in a letter dated November 4, 2011 that also responds to DEQ's September 22, 2011 comments letter. Step 2 of the Framework involves finalizing the designs of the HC&C system and performance monitoring network. Construction and initial testing of the HC&C system will be conducted under Step 3 and is scheduled for completion by the end of 2012. DEQ accepted the Framework as modified by our letter dated December 7, 2011. The December 7th letter should be referred to for additional details regarding DEQ's objectives for planning, designing, and constructing groundwater source control measures.

DEQ requests a meeting be arranged as soon as practicable to discuss the modeling comments included in the attachments. Please feel free to contact me with questions regarding this e-mail and/or the attachments, or to discuss dates for the proposed meeting.

Mr. Dana Bayuk, Project Manager
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Please visit our website at http://www.oregon.gov/DEQ/

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Footnote #1. Anchor QEA, LLC, "Revised Groundwater Source Control Construction Design Report, NW Natural Gasco Site," January 2012 (received January 31, 2012), a report prepared for NW Natural.

Footnote #2. Anchor QEA, LLC, 2011, "Draft Groundwater Source Control Final Design Report, NW Natural Gasco Site," May (received May 9th), a report prepared on behalf of NW Natural (DEQ recognizes the document as being the equivalent of the Revised Groundwater Source Control Interim Design Report)

# Comments on Revised Groundwater Source Control Construction Design Report, NW Natural GASCO Site, Portland, Oregon Dated January 2012

Comments dated May 4, 2012

The following are EPA comments on the *Revised Groundwater Source Control Construction Design Report* document, dated January 2012, prepared by Anchor QEA, LLC on behalf of NW Natural.

## General Comments

1. EPA has reviewed the revised Construction Design Report (CDR) and notes that while NW Natural has made improvements to the Final Design Report (CDR precursor report) submitted May 2011, the revised document still does not provide enough description in the narrative or elaboration on key concepts and calculations to support results in many key sections. Sections in particular where issues remain are commented on in the specific comments below.

2. EPA provided NW Natural comments on the March 2011 *Segment 2 Capture Zone Field Test Report* (transmitted via e-mail on April 25, 2011) and responded to additional information from the May 2011 *Segment 2 Field Tests of the Programmable Logic Control and Variable Frequency Drive Well Pumps* (transmitted via e-mail on July 7, 2011). To date, we have not received any substantive responses to these comments. As such, NW Natural makes general statements related to the demonstration of capture effectiveness throughout the entirety of groundwater flow regime underlying the Gasco Site that EPA has not resolved with NW Natural and simply cannot agree with.

## Specific Comments

1. **Section 2.1.3, page 10, third paragraph:** EPA received a technical memorandum titled *NW Natural Gasco Site: Documentation of Groundwater Model Modifications Since 2008*, dated April 12, 2012, and prepared by Anchor QEA, LLC on behalf of NW Natural. EPA understands that this memorandum constitutes Appendix F, which was empty in the January 31, 2012 CDR. Comments specific to the modeling update are presented in a separate section below titled *"Appendix F Comments."*

2. **Section 3.2.1.1, page 21, paragraphs 3 and 4, and page 22, last paragraph of section:** Although free cyanide detections are lower than total, more explanation of the implications for those areas where free cyanide detections exist is needed. Furthermore, free cyanide concentrations are noted as generally being below 10 micrograms per liter (µg/L), but there is no discussion or analysis as to what this means in terms of toxicity. A brief mention of basic statistics on detections in the last paragraph indicates only 4 out of 180 samples had detection of free cyanide, but in those 4 detections concentrations were as high as 140 µg/L and no explanation is given on the implications of this concentration level, or what

monitoring well had this high detection. Also, it appears the free cyanide data has been submitted to a variety of labs with different detection limits; some detection limits appear to be as high as 10 µg/L, while others have detection limits as low as 5 µg/L. Therefore, it is incorrect to make general conclusions about the number of detections versus samplings when there is inconsistency in laboratory detection limits within the data set.

3. **Section 3.2.1.2, page 23, paragraph 2, last sentence:** More explanation on what the significance lag time has on the hydraulic control and containment (HC&C) system is needed. This explanation is necessary to address several comments EPA presented on the May 2011 *Segment 2 Field Tests of the Programmable Logic Control and Variable Frequency Drive Well Pumps* (submitted to NW Natural in an EPA e-mail dated July 7, 2011) that related to uncertainty in the HC&C system being able to demonstrate sustained and effective capture of contaminant discharge to the river while dynamic changes occur between the groundwater and the river.

4. **Section 3.2.1.3:** This section is too limited to the discussion of hydraulic conductivity. EPA believes more information was gleaned from these Segment 2 tests and incorporated into the site groundwater MODFLOW model than just hydraulic conductivity. This information should be summarized in the narrative within this section. EPA expects the discussion to include a summary of additional hydraulic information and well performance that were discovered in Segment 2 testing.

5. **Section 3.2.1.4, page 25, paragraph following model parameter table:** EPA believes it is unconventional to ignore slug test results for a hydrostratigraphic layer represented in the model (Fill WBZ) because inputting the site specific data would throw off model calibration. The issue of the model going out of calibration may be related to a different parameter that could be creating the discrepancies between modeled and measured groundwater heads. This issue should be looked into, not ignored. Furthermore, EPA believes it is premature to state that assuming a higher hydraulic conductivity is conservative without fully understanding other critical hydraulic parameters that may be influencing groundwater heads.

6. **Section 3.2.1.4, page 26, paragraphs 2 through 4:** A groundwater flow budget is presented with an illustration of flow budget components on Figure 3-4. However, there is no documentation or calculations explaining how these flow budget values were derived. The flow budget components need to also be presented in a way that a reviewer can verify the budget components are balanced (e.g., Inputs = Outputs). This is usually shown in a water budget table. Also, some flow budget components seem to conflict with statements made in the text, or raise additional questions, for instance:

   - The narrative on anticipated interceptor trench discharges indicates flows will be 10% of the total discharge from the alluvium WBZ HC&C system (Section 3.2.2.1, page 33). However, flow from the trench is shown at 9 gallons per minute (gpm), which is only

3.5% of the total discharge shown for the HC&C. It is possible that these lower flows are the result of post site paving, but this needs to be explained/presented.

- Recharge of 45 gpm appears to be assumed to infiltrate into the fill unit; however, this may not be reasonable with the assumed paved site conditions. Again, presentation of calculations that derived these values is essential to allow for review and improve confidence that these values are correct. The component of flow that 5 gpm discharging downgradient of the wall represents should be presented. It seems relatively significant since it represents over 50% of the flow expected from the interceptor trench and may indicate that flows within the Fill hydraulically downgradient of the interceptor trench (if this is what the 5 gpm represents) need to be captured and a modification to the proposed HC&C system should occur.

7. Section 3.2.2.1, page 32, second paragraph: Based on the narrative in this paragraph, that essentially defers any revision or discussion on the Fill WBZ interceptor trench, EPA cannot concur with this design element of the CDR until such revision and documentation has been produced.

8. Section 3.2.2.2.1, page 35, last bullet: NW Natural should describe how the 8 to 5 gpm reduction in flow rates necessary for hydraulic control in the upper alluvium through the addition of extraction wells was determined. More information and calculations need to be presented so the reader can understand how the reduction in flow was determined.

9. Section 3.2.2.2.1, pages 35 and 36, and Tables 3-4a and 3-4b: EPA has the following comments on the analysis and presentation of material in these two tables and the accompanying narrative:

   - It is uncertain if the tested specific capacities shown in Table 3-4a have been determined from stabilization, or if drawdown continued at the end of testing. A footnote should describe and verify this.

   - Due to well losses, the production capacity of a well is not constant and varies inversely proportional with discharge. At lower rates, capacities are at maximum, but then decline at higher rates due to well losses. Therefore, maximum possible pumping rates determined directly from specific capacities during tests at much lower rates are not realistic and should not be presented as such. Additional analysis should be performed to realistically provide maximum possible pumping rates accounting for the increased effects of drawdown at higher rates due to well losses. Furthermore, maximum possible pumping rates are not relevant information, rather, the maximum pumping rate required for maintaining capture (as measured by the negative delta between the river stage and upland groundwater levels) should be evaluated. The Segment 2 pumping tests showed that higher rates were necessary for the extraction wells to meet negative deltas in the monitoring network. NW Natural should evaluate these maximum pumping rates based on applicable specific capacities estimated for these rates.

- The statement in the last sentence of the second paragraph on page 36 is fundamentally incorrect. Specific capacity does not increase with a lower pump setting. It is possible NW Natural meant to state "well capacity" instead of specific capacity, which would make the statement correct.

- Regarding the discussion at the top of page 36, it is unclear what supporting documentation exists that hollow stem auger drilling smears the borehole well more than other methods of drilling used at the site, such as sonic, or cable-tool. NW Natural should present or reference literature that supports this statement. EPA believes the low specific capacity obtained at PW-8-39 should not be ignored, just because it is low. If the specific capacity of wells were 50% less than the lowest assumed specific capacity in the table (1.0 gpm/ft of drawdown), which is still above the specific capacity determined at PW-8-39, many of the upper alluvium wells would not meet sustainable pumping rates under seasonal low groundwater conditions. This possibly will not be fully understood until additional upper alluvium wells are installed, but the limited data that exists (not ignoring PW-8-39) suggests there are capacity limitations for the upper alluvium extraction wells at certain times of the year and NW Natural should note this in the narrative and on Tables 3-4a and 3-4b as well as reiterate the contingency plan of adding additional extraction wells for such an occurrence.

10. **Section 3.2.2.2.1, page 38, first paragraph:** In Oregon Department of Environmental Quality's (DEQ) December 7, 2011 submittal (see Attachment B - EPA Specific Comments; Category 1, Item 30, EPA Comment 3), EPA requested that NW Natural present additional figures showing hydraulic response within the primary water bearing units (Fill, Upper Alluvium, Lower Alluvium- above and below the confining layer). The comment specifically requested that more than particle capture maps as shown on Figures 3-2a through 3-2e (e.g., modeled head maps) are needed to illustrate extraction well influence based on long-term, sustainable pumping rates. Please note that presentation of modeled heads is standard practice for instilling confidence in the particle tracks produced by the numerical model (see EPA's *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems*, EPA 600-R-08-003, January 2008, page 23). These head maps would show drawdown and gradients developed from the extraction system that could be used to verify the selected locations of control wells and monitoring wells for controlling variable frequency drive (VFD) pumps and assessing hydraulic capture. NW Natural replied to EPA Comment 3 referenced above that "*Yes, these additional figures will be provided in the Construction Design Report.*" However, no such drawdown/modeled head maps exist in the report, only additional particle track maps for tracking contaminants originating upgradient of the extraction wells. Therefore, EPA feels, with regards to providing the necessary illustrations to evaluate monitoring well and control well locations, NW Natural has been non-responsive to EPA's referenced comment. EPA expects NW Natural to provide head maps for each stratigraphic layer under the same pumping conditions that produced the particle capture maps shown in Figures 3-2a through 3-2e.

11. Section 3.2.2.2.1, Table 3-4b and page 38: The analysis presented on sustainable pumping rates is deficient in terms of evaluating sustainable capture under seasonal changes. EPA understands that a range of flows will be required from the VFD pumps (this is stated in the last sentence on Page 38 of the CDR above the table embedded in the text showing predicted steady-state pumping rates), yet only the average pumping rate is presented. NW Natural should review Segment 2 pumping test data to determine the maximum flow rates and durations that were necessary to achieve control of the hydraulic gradients to the offshore piezometers (the furthest extent of hydraulic control). This information, in addition to historical water level monitoring data at the site, should then be used to determine deltas between groundwater heads and river stages under seasonal conditions when the river stage is at its lowest and groundwater gradients are at their highest. This will estimate and present the maximum extraction well flow rates and durations needed to achieve measureable gradient reversals at monitoring wells and offshore piezometers used for the hydraulic control verification. These maximum flow rates should then be evaluated against those determined as sustainable in both upper (Table 3-4b) and lower (no table provided) alluvium extraction wells to understand if deficiencies exist in the HC&C design.

12. Section 3.2.2.2.2: EPA has the following comments regarding this section:

    The bulleted list on page 40 should footnote that actual slot size and sand pack gradation will be determined based on actual field conditions.

    EPA notes that NW Natural justifies its selection of filter pack based on a generalized grain size analysis of 10-20 filter pack from Oglebay Norton that was provided in 2006. NW Natural should be aware that sand pack gradations vary between manufacturers and over time. Therefore, it is important to obtain current specifications of the sand pack gradation curves from the supplier of the sand pack material to be delivered on site and that a quality control check of filter pack should be conducted prior to use and placement at each extraction well. The pack should meet the specifications by the manufacturer within a tolerance of 10% for the specific gradation range type curve.

13. Section 3.2.2.2.2, page 42, first paragraph and bullets regarding well efficiency determination: The referenced Driscoll text presents several methods and equations for determining well efficiency. EPA comments did not recommend a specific method to calculate well efficiency to NW Natural. For clarification, NW Natural should provide a description of the methodology that was used as well as the page and section number within the Driscoll reference that presents the limiting factors of the specific analysis. Nevertheless, if NW Natural believes a particular method is deemed inappropriate, it is the responsibility of NW Natural to select a method that is appropriate for site conditions. Statements made by NW Natural that well efficiencies are not the result of well construction or design have not been supported with any substantive data or information. Although it may not be well design, it could be other factors related to well construction such as insufficient well development. EPA expects NW Natural to determine efficiency of these wells using whatever method is most appropriate because this information is vital for

evaluating where improvements in well design and/or well development can be made to operate the HC&C system in an effective manner that not only provides more certainty in meeting the remedial action objective (RAO), but also minimizes energy costs expended to operate this long-term remedial action. EPA notes that NW Natural proceeds at their own risk in moving forward with the implementation of the HC&C system without fully evaluating the cause and relationship of well losses in the existing extraction wells.

14. Section 3.2.2.5.2, Capture Assessment: EPA notes that the capture assessment narrative continues to appear severely limited and simplistic. This is based on the following which was highlighted in EPA's set of comments attached to DEQ's December 7, 2011 submittal (see Attachment B – EPA Specific Comments; Category 1, Item 30, EPA Comment 19). Concepts transmitted within this previous comment include the following:

    - Control wells were too close to extraction wells to verify reverse gradient conditions at locations in the aquifer further away from the extraction well.

    - Performance monitoring in the CDR needs a better explanation in terms of how and when hydraulic capture is assessed using data downloaded independently from the established monitoring wells/piezometers and integrated into the single control well.

    - NW Natural should include more wells, including offshore piezometers, in the real-time control of pumping rates and assessment of capture. Controlling the extraction well pumping rates with a single control well is too simplistic to ensure that hydraulic capture (as defined by a negative delta between upland groundwater heads and the river stage at all times) is achieved within the hydrostratigraphy that underlies the Gasco Site.

    Based on EPA's review of the revised CDR, no text has been added to clarify how selected monitoring wells will be used to maintain the necessary gradient reversals required for achieving the groundwater RAO (see Section 1-2). EPA understands this information is available from NW Natural's evaluation presented in the *Segment 2 Field Tests of the Programmable Logic Control and Variable Frequency Drive Well Pumps* document, dated May 2011. This evaluation included deltas between groundwater heads at various monitoring wells and piezometers and the river stage to determine if hydraulic control had been achieved. It is EPA's expectation that this assessment on all of these instrumented monitoring locations (shown in Table 3-5) will be made in real time and inform the pumping rates for the individual wells in the extraction system to ensure capture is being achieved at all times. It remains unclear how a single control well for each extraction well, as maintained in the revised CDR, will achieve that same level of real-time evaluation and certainty that hydraulic control is being achieved at all times. EPA recognizes that several monitoring wells are instrumented with sensors and dataloggers, but these appear to be only downloaded intermittently, so it begs the question how this information can be used to verify hydraulic control at all times. To be clear, learning that a gradient reversal was not achieved from upland pumping for several weeks after downloading, reducing, and

evaluating datalogger information is not real-time control. EPA's expectation is for NW Natural to present a detailed description of each control well, set points for controlling the pumps, how these set points were established, and how the control wells will ensure hydraulic control at capture assessment locations throughout the site and offshore to the extent of the FAMM dock is occurring at all times. Until this information is provided, EPA feels NW Natural is non-responsive to EPA's Comment 19 presented in the December 7, 2011 DEQ submittal.

In summary, there currently exists too much uncertainty regarding when instrumented monitoring wells and offshore piezometers will be evaluated to verify gradient reversals are being achieved. If not performed in real-time or used to control pumping rates, it would appear hydraulic control of groundwater discharge will only be assessed and corrected (if necessary) after a manual download of datalogger data and evaluation is performed. This is inconsistent with EPA's expectation that complete hydraulic capture of groundwater discharge through the site will be achieved and verified at all times. NW Natural should recognize that certainty of hydraulic control must be met with real-time assessment, not after months of unknown performance of the extraction system while data are collected, reduced, and evaluated from instrumented monitoring wells and offshore piezometers.

## Appendix F - Groundwater Model Documents Comments

The following are EPA comments on the memorandum titled *NW Natural Gasco Site: Documentation of Groundwater Model Modifications Since 2008*, dated April 12, 2012, prepared by Anchor QEA, LLC on behalf of NW Natural. EPA understands this memorandum constitutes Appendix F – Groundwater Model Documents, which was not provided in the January 2012 CDR submittal.

### General Comments

1. EPA notes that this memo addresses many of the outstanding requests for additional numerical groundwater model documentation (see comments EPA provided for the May 2010 Draft Final Design Report and attached in DEQ's September 22, 2011 letter). However, some comments have not been addressed. These include the following:

   a. **EPA Specific Comment 4**; *Section 3.2.1.4, page 19, paragraph 1, last bullet: Additional figures, as a result of additional modeling runs, as referenced in the bullet, do not appear in the report, or Appendix F where the groundwater modeling documents are presented. These simulations may be critical to the final design and should be provided for review.*

   **NW Natural Response** (November 4, 2011 letter): *The bullets reference specific documents prepared for ODEQ. These will be appended to the model documentation in the Construction Design Report.*

   b. **EPA Specific Comment 5**; *Section 3.2.1.4 page 20: Groundwater inflows shown in the table need to be broken out to present the components of flow in the horizontal as well as vertical direction. For instance, NW Natural should present how much flow contribution the Fill has to*

*the Upper Alluvium and the Upper Alluvium to the Lower Alluvium. This will help quantify the amount of flow lost to the alluvium as a result of future site paving and the interceptor trench constructed in the fill WBZ. NW Natural should evaluate these changed conditions using the model and present the results (see General Comment 3).*

NW Natural Response (November 4, 2011 letter): *Yes, this table will be revised and further explained in the Construction Design Report. Yes, this will be done and the findings described in the Construction Design Report.*

Furthermore, EPA presents additional comments specific to the analysis and conclusions presented by NW Natural in the April 12, 2012 memorandum (see Appendix F Specific Comments below).

2. NW Natural makes several statements that the numerical groundwater model is conservative in that it simulates greater groundwater flows than those that are believed to exist under actual site conditions. However, the supporting evidence that actual site conditions present lower groundwater flows is flawed in that the basis of evidence appears to be linked solely to a comparison of hydraulic conductivity. This is detailed further in the following paragraphs:

   a. NW Natural links under-predicted heads at MW-10-61, MW-14-110 and MW-15-66 to the assumption/extension of higher hydraulic conductivity (K) values assigned to the model extending upland. NW Natural implies an extension of higher K values in the upland direction is not realistic, but does not present evidence for this conclusion. EPA believes there are other hydraulic parameters, if set incorrectly, that can result in under-predicted heads (e.g., storage coefficients and vertical/horizontal recharge), yet none of these alternative factors appear to be described in the memorandum in relation to their sensitivity to modeled head conditions.

   b. NW Natural uses specific capacity derived from Segment 2 tested wells to derive hydraulic conductivity values that are assumed to be more accurate, and an order of magnitude lower, than current model assignments. NW Natural presents a case that this is a conservative approach and that the hydraulic conductivity assigned to the intermediate alluvium WBZ is too high. EPA is concerned with this analysis since the specific capacity value employed does not factor out well losses and the screen interval length was assumed for the entire aquifer thickness. EPA has noted previously that well losses were present in these extraction wells and that the screens do not fully penetrate the aquifer.

   For a complete evaluation of the "conservative" aspects of the model, NW Natural should evaluate and describe all factors that may be influencing groundwater heads (not just hydraulic conductivity). The analysis should also evaluate and describe factors contributing to bias within the presented pumping well data analysis (e.g., well losses) that might incorrectly point to lower K values than actual. As a result, the calibrated model and its predicted higher groundwater flows may be a more reasonable flow value that NW Natural

should prepare to control with the proposed HC&C system. In addition, NW Natural should recognize that the number of wells needed to control the model predicted groundwater flow may be under predicted because of inherent issues with individual well losses.

Specific Comments

1. **Expansion of the Groundwater Model to the U.S. Mooring Site Section:** NW Natural should present more information that supports the stated conclusion that the extension of the model area does not "significantly" change flow patterns on the Gasco Site. EPA expects this qualitative term to be supported with illustrations (e.g., gradient vector maps) showing flow patterns and magnitude under pre- and post-model domain extension.

2. **Model Grid Refinement, second paragraph:** The modeled head to observed head comparison scatter plots are difficult to follow with the text, which describes a spatially distributed comparison of groundwater heads throughout the site. NW Natural should supplement the head comparison scatter plots with maps showing calibration between modeled and observed heads at site specific well points. This will allow one to follow along with statements such as, "The calibration in the alluvium is better in the nearshore area where water levels are close to river stage and at the upland boundary." As currently presented, a reader cannot discern what alluvium scatter point is associated with a well located in the "nearshore area."

3. **Model Grid Refinement, second and third paragraphs, pages 3 and 4:** See EPA General Comment 2 with regards to the conservative aspects to the numerical model and HC&C design implied by NW Natural. A more elaborate explanation of how these differences present a conservative approach to HC&C design is needed. NW Natural should evaluate the root cause for the discrepancy between modeled and calculated site groundwater flow since there are other model parameters besides hydraulic conductivity that can present variability in groundwater heads.

4. **Refinement of Shallow Alluvium Hydraulic Conductivity, first paragraph, page 4:** EPA notes a range of transmissivity values have been determined for three wells completed in the shallow alluvium WBZ. However, NW Natural should reference the document that shows the analyses that were used to derive them. Furthermore, an explanation of the large variability in transmissivity values for each well should be provided, if not provided in the source document.

5. **Deep Aquitard, first paragraph, second sentence, page 7:** NW Natural should present information that supports their conclusion that the deep aquifer "has a limited areal extent both upland and offshore." This appears to contradict a major study near the Gasco Site (i.e., Starlink Logistics 2010 Draft RI/SCE Report) which presents evidence of a channel of coarse grained Alluvial/Colluvial gravel deposits that connect this deep aquifer to upland areas towards the southeast well beyond the limits shown in Figure 5. If present, groundwater discharge through this more aerially extensive permeable aquifer may be

greater than anticipated, and currently modeled, by NW Natural resulting in the inability to capture groundwater discharging through this layer with the current HC&C design.

6. **Deep Aquitard, last paragraph, page 7:** NW Natural should explain how they determined that the horizontal discharge through the deep aquifer is less than vertical discharge and what the anticipated horizontal groundwater flow to vertical flow in the deep aquifer is. As recommended in EPA's *Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems*, EPA 600-R-08-003, January 2008 (see page 14), NW Natural should present this information with flow vector arrows that represents the average flow rate and direction for each model grid cell. Furthermore, NW Natural should present the groundwater discharge in the deep aquifer that the scenario in Figure 6 is based on and evaluate whether or not this is achievable under higher groundwater flow rates, especially given the evidence from a neighboring upland property conceptual site model (see Appendix F, Specific Comment 5) that this deep aquifer is more extensive than assumed in NW Natural's groundwater model.

7. **Deep Aquitard, last sentence, last paragraph, page 8:** NW Natural should provide more detail and explanation of the alternative analysis using gradient and conductance to determine whether wells or the river is the least resistant flow path. To clarify, EPA assumes NW Natural is referring to specific conductivity when using the term "conductance." As written, is not clear how these parameters will be used to verify the capture of deep groundwater using the intermediate alluvium zone HC&C wells.

8. **Additional Design Features: Fill WBZ Interceptor Trench and Site Paving, first sentence, first paragraph, page 8:** NW Natural should explain how the 2-inches per year of infiltration through paved areas was derived.

9. **Additional Design Features: Fill WBZ Interceptor Trench and Site Paving, last sentence, first paragraph, page 9:** NW Natural should explain how "the Siltronics property and former Doane Lake area contribute more groundwater flow to the Gasco property as recharge is reduced." This explanation should include a description of model assumptions that may factor into a constant supply of groundwater (e.g., through modeled head boundaries) that may not be realistic for site conditions at certain times of the year. Furthermore, NW Natural should provide the quantity of additional groundwater flow from Siltronics and the former Doane Lake area and the supporting analysis that this statement is based on.

10. **Additional Design Features: Fill WBZ Interceptor Trench and Site Paving, last sentence, second paragraph, page 9:** NW Natural should present how much water levels decreased on the upland side of the trench, as well as the hydraulically downgradient side. As currently written, a reader does not know what level the water levels decreased to from the "approximately 20 feet level on the upland side of the trench", or what "nearly river level" is in relation to ground surface hydraulically downgradient of the trench. A simplified cross-section would be better suited to present this information.

11. Additional Design Features: Fill WBZ Interceptor Trench and Site Paving, second to last paragraph, page 9: NW Natural should present more of the analysis that was used to support the bulleted statements. EPA finds it difficult to believe the "Fill WBZ interceptor trench does not dewater the fill upland of the trench" to some degree and reduce recharge to the upper alluvial aquifer that might in turn affect the performance of the upper alluvial HC&C wells. As currently written, there is no presentation of evidence that leads EPA to believe with certainty that site paving and the interceptor trench will not impact the available drawdown and capacity of the upper alluvium wells.

12. Simulation of the Variable Rate Pumping Test, pages 9-14: EPA understands the purpose of a control well is to control a VFD pump in a specific extraction well. However, EPA believes a control well and the delta between it and the river stage is not the definitive assessment of whether or not hydraulic control of groundwater discharging under the site to the river is being achieved. For this assessment, the network of upland and offshore monitoring locations shown in Table 3-5 of the January 2012 CDR should be evaluated in real-time to verify that a gradient reversal is being achieved for all flow paths within the hydrostratigraphic layers underneath the Gasco Site. EPA feels this is an important distinction between the role of the control wells for controlling VFDs and the overall confirmation that the groundwater RAO is being met.

13. Simulation of the Variable Rate Pumping Test, last two paragraphs page 14: See Appendix F, General Comment 2. EPA has a concern with NW Natural's analysis using specific capacity to estimate hydraulic conductivity. This analysis does not factor out well losses in the specific capacity assignment in the equation and the use of the well screen interval for aquifer thickness greatly underestimates the thickness of the aquifer. Therefore, the comparison between calculated and modeled site hydraulic conductivity conditions cannot be made with any degree of confidence. NW Natural should re-evaluate this, incorporating well losses and the full thickness of the aquifer.

# DEQ'S COMMENTS TO: 1) NW NATURAL'S NOVEMBER 4, 2011 RESPONSES TO THE SEPTEMBER 22, 2011 MODELING-RELATED COMMENTS ON THE REVISED INTERIM DESIGN REPORT; AND 2) APPENDIX F OF THE REVISED GROUNDWATER SOURCE CONTROL CONSTRUCTION DESIGN REPORT

Comments dated July 18, 2012

## NW NATURAL'S RESPONSES TO DEQ'S SEPTEMBER 22, 2011 MODELING-RELATED COMMENTS

### General Comment

**Transient Groundwater Modeling.** NW Natural responded to DEQ's comments on the Revised Interim Design Report[1] in a letter dated November 4, 2011. Attachment B of the November 4, 2011 letter organizes NW Natural's responses into two general categories. One category (Category 1) is intended to identify DEQ comments that NW Natural understands are related to design and construction of the Alluvium water-bearing zone (WBZ) hydraulic control and containment (HC&C) system. The second category is based on NW Natural's understanding that DEQ's comments involve additional evaluations of post-construction operation and performance (Category 2). Many of the Category 1 and Category 2 responses recommend conducting "transient" groundwater modeling following construction and initial testing of the HC&C system. Transient modeling would occur during preparation of the Operations and Performance Monitoring Design Report (Operations Design Report) referenced in the Construction Design Report[2].

DEQ approves NW Natural proposal to conduct transient groundwater modeling after the HC&C system is constructed and tested. DEQ understands the data collected during initial testing of the full-scale HC&C system will be incorporated into the model before transient simulations proceed. Consistent with previous correspondence, DEQ expects transient simulations to verify the MODFLOW model's ability to simulate groundwater flux and hydraulic head conditions resulting from seasonal changes in groundwater recharge, river stage, and fluctuating tidal conditions. DEQ anticipates transient modeling will include, but not necessarily be limited to; verifying the MODFLOW model using data collected during the Segment 2 extraction well pilot test(s) and the hydraulic control and containment (HC&C) system shake-down tests.

**Category 1, Comment 2, 1st bullet page 7 (also Category 2, Comment 1).** DEQ believes this comment is addressed under the Framework for finalizing the design and constructing the Alluvium WBZ HC&C system. Simulations of the HC&C system under seasonal extremes will be completed prior to finalizing the designs of the remaining extraction wells in the HC&C system (i.e., prior to initiation of construction). This modeling work will not be postponed until preparation of the Operations Design Report.

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[1] Anchor QEA, LLC, 2011, "Draft Groundwater Source Control Final Design Report, NW Natural Gasco Site," May (received May 9th), a report prepared on behalf of NW Natural (recognized being the equivalent of the Revised Groundwater Source Control Interim Design Report).

[2] Anchor QEA, LLC, "Revised Groundwater Source Control Construction Design Report, NW Natural Gasco Site," January 2012 (received January 31st), a report prepared for NW Natural.

Two scenarios encompass the seasonal extremes needed to assess long-term operation and performance of the HC&C system, including conditions of river stage and groundwater levels which would:

- Maximize groundwater flux through the Alluvium WBZ; and
- Minimize available drawdown to the upper Alluvium WBZ extraction wells.

For clarification, DEQ considers simulations using March 27, 2000 water level data to be acceptable for: 1) assessing the potential maximum seasonal groundwater flux through the Alluvium WBZ; and 2) estimating the maximum treatment system inflow rates. These simulations were completed during treatment system design and used in part to size system components. Modeling of the minimum available drawdown scenario for the upper Alluvium WBZ extraction wells will be completed consistent with the Framework as a final design evaluation step.

**Category 1, Comment 2, 1st full paragraph page 8 (also Category 2, Comment 2).** DEQ's general comment regarding transient modeling applies here.

**Category 1, Comment 15, Section 3.2.1.4 (also Category 2, Comments 7 and 8).** DEQ replies to NW Natural's responses are provided below.

**1st bullet.** Given NW Natural's deletion of the requested paragraph, DEQ considers this comment to be addressed.

**2nd bullet.** As indicated above, the Framework addresses this comment. Simulations of the seasonal conditions which would minimize available drawdown for the upper Alluvium WBZ extraction wells will be completed during extraction well final design.

**3rd bullet.** On behalf of NW Natural, Anchor submitted a supplement to Appendix F of the Construction Design Report titled, "NW Natural Gasco Site: Documentation of Groundwater Model Modifications Since 2008" dated April 12, 2012 (April 12th Memorandum) to address this comment. DEQ's comments on the April 12th Memorandum are provided below in a separate section of this letter.

**4th bullet.** NW Natural responds to this comment by including a water budget in the Construction Design Report (see Figure 3-4) that is based on the MODFLOW model. However, there does not appear to any information provided in the Construction Design Report to document the source(s) of values shown in Figure 3-4. NW Natural should explain the basis for the water budget and each of the component values shown.

**5th bullet.** DEQ accepts Figure 3-4 as responding to our request for information regarding the estimated extraction rates for the upper and lower Alluvium WBZ extraction well groups. Under the assumption of a reasonable worst-case maximum seasonal groundwater flux through the Alluvium WBZ, DEQ understands the upper and lower Alluvium WBZ well groups are estimated to extract 50 gpm and 210 gpm respectively.

NW Natural did not provide information on whether the lateral and vertical extent of the capture zone produced by operating the HC&C system during conditions of maximum groundwater flux are anticipated to be the seasonal minimum, average, or maximum. DEQ requests the lateral and vertical extent of capture zones produced by operating the HC&C system under the two seasonal extreme scenarios (i.e., maximum groundwater flux, minimum available drawdown) be considered, compared, and discussed during final design of the remaining extraction wells.

**6th bullet.** DEQ's comment requested additional information regarding the following:
1. Figures depicting the captures zone(s) for the HC&C system with depth;
2. Cross-sectional views of capture zones through extraction wells PW-2, PW-6, and PW-9; and
3. The times after start-up the intermediate and final capture zones represent.

NW Natural's responses to items #1 and #2 are acceptable to DEQ. For Item #1 NW Natural includes figures 3-2.a through 3-2.e in the Construction Design Report to illustrate capture zones in the Alluvium WBZ at the depth intervals requested by DEQ. In response to DEQ's request for Item #2, NW Natural provides a figure with particle tracks to illustrate vertical capture along a cross-section through extraction well PW-5 along with an explanation of why the cross-sections DEQ requested were not produced.

Information for Item #3 is not provided in the Construction Design Report and should be provided when the final design modeling scenario is completed.

Regarding figures 3-2.a through 3-2.e, given the figures illustrate the results of simulations for the Alluvium WBZ, DEQ understands the contraction and/or loss of the capture zones associated with extraction wells PW-9-92 and PW-10L are due to the shallower occurrence of the basalt in this portion of the site. However, the reason(s) for the expansion of the PW-01U,L and PW-02U,L capture zones out under the river, and the associated irregular particle tracks should be further explained (see especially figures 3-2.c through 3-2.d). This information should be provided when the final design modeling scenario is completed.

**7th bullet.** DEQ's comments regarding the hydraulic properties of the Fill WBZ related to the MODFLOW model are included below with those provided for the April 12th Memorandum.

**Category 1, Comment 15, last paragraph (also Category 2, Comment 9).** DEQ's general comment regarding transient modeling applies here.

**Category 1, Comment 16, Section 3.2.1.5.** NW Natural responds to DEQ's comment by indicating figures 3-5.a and 3-5.b (formerly figures 3-3.a and 3-3.b) are drawn through extraction wells PW-13, and PW-4U and PW-4L respectively. NW Natural's response is acceptable to DEQ.

**Category 1, Comment 17, Section 3.1.9.** NW Natural responds to DEQ's comment requesting documentation of the updates made to the MODFLOW model by submitting the April 12th Memorandum. DEQ's comments on the April 12th Memorandum are provided below in a separate section of this letter.

NW Natural also informs DEQ that if water levels in the Alluvium WBZ are predicted to occur below the bottom of the upper silt unit, the model calculates transmissivity based on saturated thickness and the storage coefficient for the unconfined condition is used. NW Natural response is acceptable to DEQ.

**Category 1, Comment 18, Section 3.2.2.2.1, 1st paragraph page 29 (also Category 2, Comment 10).** As indicated above, the Framework addresses this comment. Simulations of the seasonal extremes of river stage and groundwater levels which would minimize available drawdown for the upper Alluvium WBZ extraction wells will be completed as part of completing the final extraction wells design of evaluating the long-term operations and performance of the HC&C system design. The design of the upper Alluvium WBZ extraction wells, including pump placement; will be considered in the context of these simulations.

**Category 1, Comment 19, Section 3.2.2.2.1, 1st paragraph page 30.** DEQ considers NW Natural's response to our comments to be acceptable. NW Natural confirms DEQ's understandings of the modeling scenario used to produce capture zone figures 3-2.a through 3-2.e in Section 3.1.4 of the Construction Design Report, and provides documentation of changes made to the model in the April 12th Memorandum.

**Category 1, Comment 20, Section 3.2.2.5.2, 1st paragraph.** DEQ accepts the April 12th Memorandum as responding to our comment regarding the current status of the MODFLOW model. DEQ's comments on the April 12th Memorandum are provided below in a separate section of this letter.

**Category 1, Comment 20, Section 3.2.2.5.2, 6th and 7th paragraphs (also Category 1, Comment 4, 5th bullet page 11 and Category 2, Comments 4, 5, 12).** DEQ does not accept NW Natural's response to this comment. The ΔH value is a critical design parameter for the HC&C system as it controls the magnitude of the hydraulic gradient between the river and the HC&C control wells. From the standpoint of HC&C system operation, the delta value must be equaled or exceeded at control wells on an average basis for the HC&C system to be effective. DEQ understands NW Natural's recommendation to provide ΔH values during the startup process postpones evaluation of this important design parameter until after the HC&C system is fully constructed. This proposal is not approved by DEQ.

DEQ believes evaluation of ΔH values should occur before the HC&C system is constructed. However, DEQ also acknowledges NW Natural's assertion that the selection of ΔH values for operation of the HC&C system should be based on the data from full-scale testing. In general, DEQ's believes the selection of operational parameters (e.g., limits on extraction well pumping rates) and performance criteria (e.g., ranges of horizontal and vertical gradients expected to minimize potential DNAPL movement) will benefit from full-scale testing of the HC&C system. That said, NW Natural's reasons for not providing estimated ΔH values (or a range of values) as projected performance criteria which will be refined during HC&C system shake-down testing are unclear to DEQ. DEQ believes this topic warrants additional discussions, including NW Natural's proposed approach for evaluating and selecting ΔH values, as well as other operational parameters and performance criteria. Besides ΔH values at control wells, DEQ requests NW Natural provide additional information about the criteria that will be used to determine hydraulic

control and containment is being achieved at monitoring wells and piezometers in the performance monitoring program (i.e., at installations other than control wells).

DEQ's comment also requests NW Natural to provide information as to how factors unrelated to operation of the extraction wells will be accounted for in selecting ΔH values. As indicated in DEQ's general comments to the Revised Interim Design Report, NW Natural's presumption that during Segment 2 pilot well tests groundwater level changes and gradient changes observed between pre-pumping and pumping periods were due entirely to the influence of extraction wells could lead to overestimating the effectiveness of the HC&C. DEQ requests NW Natural to provide additional information on how factors such as river stage and tidal fluctuations will be incorporated into evaluations and selection of ΔH values.

## CONSTRUCTION DESIGN REPORT, APPENDIX F

DEQ reviewed model documents contained in Appendix F of the Construction Design Report. In response to DEQ's comments on the Revised Interim Design Report, NW Natural submitted the April 12th Memorandum as a supplement to Appendix F. As requested by DEQ in our comments to Section 3.1.9 of the Revised Interim Design Report, the April 12th Memorandum provides additional documentation of the MODFLOW model.

DEQ's comments on Appendix F are provided below.

### General Comment

Modeling documentation lacks consistency and presumes there is a general understanding about the model, model development, model parameters, and uses of the model. This is not the case. DEQ is aware of many versions of the MODFLOW model which have been, or are being used to simulate specific scenarios and/or conditions. It is not clear to DEQ which version of the model is being used to assess the scenarios and site conditions described in the April 12th Memorandum. For example, are site paving and the interceptor trench now included in the working version of the model?

To reduce the potential for misunderstandings and/or miscommunications, DEQ believes it is important for NW Natural to identify which version of the MODFLOW model is being used as the baseline model for the site. If a baseline model is not being used, then NW Natural and DEQ need to establish a method for identifying which version of the model is being used to assess a specific set of site scenarios or conditions. DEQ considers this to be important given the model will be modified further based on the results of recently completed step-drawdown testing, and later by the results of the HC&C system shake-down test(s).

**Expansion of the Groundwater Model.** The April 12th Memorandum indicates the northwest boundary of the MODFLOW model encompasses the U.S. Moorings site "small boat basin." DEQ approves the expansion for the reasons cited in the memorandum.

For clarification, DEQ requests the scope of any planned future evaluations of the interceptor trench to include the section along the northern property line between the Gasco Site and the U.S. Moorings Site. DEQ also requests the MODFLOW model be used to support of this work.

**Model Grid Refinement.** DEQ's general comment about using the MODFLOW model to evaluate site scenarios or conditions applies to the information provided here regarding additional evaluations of the upland hydraulic conductivity (K) assignments. Furthermore, the written descriptive documentation provided in the April 12th Memorandum is inadequate for DEQ to review and/or comment on use of the model for the purpose described.

That said, DEQ approves NW Natural's change to the overall grid spacing of the model from a grid of 40-feet by 40-feet to 20-feet by 20-feet. Although, NW Natural considers the change in grid spacing to be unnecessary for designing the HC&C system, DEQ believes the modification could provide additional resolution of the distribution of heads and gradient changes during simulations of the seasonal conditions which would minimize available drawdown, and for purposes of modeling the influence of the interceptor trench on the Fill WBZ and transient modeling of the HC&C system.

DEQ notes NW Natural's comment regarding the poor calibration of the model to uplands water levels. NW Natural attributes the under-prediction of water levels at uplands monitoring wells MW-10-61, MW-14-110, and MW-15-66 to the extension of the "intermediate high K zone" on water levels in the uplands. The potential influence of extending the "intermediate high K zone" on water levels in the uplands is assessed in the April 12th Memorandum by reducing the K value to 5 feet/day which reportedly results in better calibration. DEQ notes the comparison of calibration results between the "Interim Design Model" and the "Construction Design Model" shown in Figure 2 would be more informative if the data points were labeled.

DEQ currently understands hydraulic conductivity assignments in the current version of the MODFLOW model are consistent with the table nested in Section 3.1.4 of the Construction Design Report. The phase "intermediate high K zone" does not appear in the table. DEQ understands from the last section of the April 12th Memorandum ("Simulation of the Variable Rate Pumping Test") the "intermediate alluvium K" was reduced to 5 feet/day from 300 feet/day (i.e., the value referenced for the "Lower Alluvium above Aquitard"). However, this appears to contradict hydraulic conductivity assignments used in the model. The bottom elevation of the three referenced monitoring wells are above or near elevation -70 feet, which is the elevation of the contact between the "Upper Alluvium" and "Lower Alluvium above Aquitard" used for modeling purposes. In other words, the model assigns a hydraulic conductivity to the "Upper Alluvium" (the material in which the wells are completed) of 10 feet/day, not 300 feet/day (the value assigned to the "Lower Alluvium above Aquitard").

Given the inconsistency in nomenclature used and lack of specificity in the description of the work done, it is difficult to understand NW Natural's comment and/or the work done to further assess the influence of alluvium K values on uplands water levels.

**Refinement of Shallow Alluvium Hydraulic Conductivity.** On behalf of NW Natural, Anchor is putting together a data package documenting recently completed redevelopment work and

step-drawdown testing at most of the upper Alluvium WBZ extraction wells. DEQ understands from telephone and meeting discussions, redevelopment measurably increased the specific capacities and well efficiencies of extraction wells PW-2U, PW-3U, PW-5U, PW-6U, PW-8-38, and PW-9-92. DEQ further understands the results of the post-redevelopment step-drawdown tests are currently being incorporated into the MODFLOW model. Consequently, DEQ will wait to provide comments on refinements made to the shallow Alluvium WBZ K values and the model after reviewing the redevelopment/step-drawdown data package.

DEQ notes that NW Natural appears to be focusing efforts to update the MODFLOW model on the Alluvium WBZ. It is less clear whether additional data for the Fill WBZ and the upper silt aquitard is also being considered. Siltronic conducted variable head tests along the shoreline, the results of which indicate the horizontal K value of the Fill WBZ ranges between 11 feet/ day and 61 feet/day (geometric mean ~ 23 feet/day). In addition, vertical permeability tests were conducted on samples from the upper silt unit collected during the remedial investigation of MGP contamination on the Siltronic property. The vertical K values base on these tests range between 0.002 feet/day and 0.004 feet/day (geometric mean ~ 0.002 feet/day). For comparison, the horizontal K value for the Fill WBZ and the vertical K value for the upper silt unit being used in the model are 10 feet/day and 0.005 feet/day respectively. DEQ requests the input parameters for the Fill WBZ and silt unit in the MODFLOW model make use of this information.

**Deep Aquitard.** DEQ preliminarily accepts NW Natural's conceptual model for the influence of the deep aquitard on the movement of groundwater in the deep Alluvium WBZ zone. NW Natural proposes that due to the nature of the alluvium and the gradients caused by the HC&C system compared to the river, groundwater in the deep Alluvium WBZ (i.e., groundwater below the deep aquitard) will be drawn to extraction wells. Consistent with DEQ's December 7, 2011 letter commenting on the proposed Framework, the conceptual model will be demonstrated using field data collected from existing monitoring wells and additional installations constructed for this purpose.

DEQ also notes the need for information requested previously regarding NW Natural's identification of the deep aquitard. As indicated in the Interim Design Report, NW Natural relied on observations made during drilling of shoreline monitoring wells and Targost® logs to develop interpretations of the depth, thickness, and lateral extent alluvial sediments, including the deeper aquitard. Stratigraphic interpretations involving Targost® borings were actually based on data generated by the cone-penetrometer tool (CPT). DEQ understands that prior to use on the NW Natural property, the Targost® probe and CPT were advanced adjacent to previously drilled and visually logged borings for comparison and correlation purposes. To date, NW Natural has not provided documentation of the work done to correlate Targost®, CPT, and boring logs. In addition, NW Natural has not showed how the correlation between the CPT and boring logs was used to identify the deep aquitard at Targost®/CPT boring locations. DEQ continues to request this information for purposes of documenting deep aquitard interpretations and for completeness.

**Additional Design Features.** DEQ's general comment about using the MODFLOW to evaluate site scenarios or conditions applies here. Furthermore, the written descriptive documentation

provided in the April 12th Memorandum is inadequate for DEQ to review and/or comment on use of the model for the purposes described.

DEQ understands NW Natural added paving and the interceptor trench to the model in response to comments received on the Revised Interim Design Report. For clarification and pending confirmation from NW Natural on how modeling was done, DEQ considers these features to be temporary additions to the MODFLOW model which are appropriate for assessing certain site scenarios. In other words, they should not be retained as permanent features in the MODFLOW model. That said, paving and the trench may be appropriate for simulations of seasonal extremes of river stage and groundwater levels which would minimize available drawdown.

**Simulation of Variable Rate Pumping Test.** DEQ's general comment about the version(s) of the MODFLOW model being used to evaluate site scenarios or conditions applies here. Furthermore, the written descriptive documentation provided in the April 12th Memorandum is inadequate for DEQ to review and/or comment on use of the model for the purposes described. DEQ understands the results of the post-redevelopment step-drawdown tests are being incorporated into the MODFLOW model. Consequently, the information provided here may change. DEQ will wait to provide comments on refinements made to the shallow Alluvium WBZ K values and the model after reviewing the redevelopment/step-drawdown data package.

## BAYUK Dana

**From:** Wyatt, Robert [rjw@nwnatural.com]
**Sent:** Monday, January 03, 2011 10:59 AM
**To:** ANDERSON Jim M
**Cc:** BAYUK Dana
**Subject:** Re: 12/13/10 Gasco Dispute Mtg

Hi Jim,

Thanks for providing the additional detail on the technical issues that need to be resolved for the HC&C design. I concur with the clarifications you provided and that this agreement moves the project out of dispute resolution and back to finalizing the source control design and risk assessment.

I hope you had a great Holiday Season and look forward to a productive New Year.

Bob

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**From:** ANDERSON Jim M [mailto:ANDERSON.Jim@deq.state.or.us]
**Sent**: Wednesday, December 22, 2010 10:32 AM
**To**: Wyatt, Robert
**Cc**: BAYUK Dana <BAYUK.Dana@deq.state.or.us>
**Subject**: RE: 12/13/10 Gasco Dispute Mtg

Bob,
I read your 12/17/10 e-mail. I appreciate NWN's decision to accept DEQ's proposal which will allow the source control project to move out of dispute resolution & back into project planning & design. Your 12/17 e-mail communicates NWN's perspective on certain aspects of DEQ's proposal..., several of which I want to clarify & present as expectations before we meet in January 2011. I believe the 2 meetings we're contemplating in 1/11 represent the best forum for identifying , discussing, & most importantly resolving technical issues associated with HC&C & the risk assessment. My clarifications are embedded in your 12/17 e-mail below & are presented in *red italic* font.

I hope this e-mail closes our formal dispute. Let's plan on talking after you return from holiday travels to arrange meeting dates & times &..., along with the technical leads..., begin to develop central meeting topics. I look forward to productive project planning meetings & getting to important source control & cleanup..., as I know you do too.

Hope you & yours have a safe, happy holiday.

Jim Anderson
Manager, DEQ Portland Harbor Section
ph: 503.229.6825
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cell: 971.563.1434

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**From:** Wyatt, Robert [mailto:rjw@nwnatural.com]
**Sent:** Friday, December 17, 2010 11:54 AM
**To:** ANDERSON Jim M
**Cc:** BAYUK Dana; DECONCINI Nina; PEDERSEN Dick; Kirkpatrick, Margaret
**Subject:** RE: 12/13/10 Gasco Dispute Mtg

Hi Jim,

Thanks very much for the meeting summary and outline of the DEQ proposed path forward. I appreciate the time and thought that clearly went into your proposal. As you know, NW Natural is interested in reaching final resolution on the dispute. Based on our telephone conversation this morning I am providing the following re-statement of the key points from our meeting on Monday that NW Natural agrees would represent that resolution. I think it is consistent with your proposal, but if there are differences please give me a call so we can discuss them further.

NW Natural agrees that the following path forward provides a good resolution for the dispute, with the understanding that all of the conditions and next steps must be completed successfully.

NW Natural understands that we will develop and submit a final design for the HC&C system along the entire length of both Segments 1 and 2. Prior to submittal of that final design the following conditions must be met:

1. Resolution of remaining design details related specifically to the HC&C system raised during DEQ review of the interim design report. *DEQ will want to include discussion/concerns we have with NWN's revised HC&C proposal presented to us in a 5/17/10 technical meeting..., & not only our 3/26/10 comments on NWN's 11/09 Interim Design Report. I suggest the 1/11 meeting we're planning focus on technical issues to be resolved to evaluate, plan, & design HC&C along the disputed portion of Segment 1.*
2. Agreement on a monitoring program for the HC&C system that will be used to determine system effectiveness and include criteria for monitoring DNAPL movement. NW Natural has proposed a monitoring program to DEQ for this purpose and understands that DEQ will provide specific revisions to supplement or modify that program. NW Natural understands that if significant DNAPL migration is observed that DEQ may require additional interim action. If significant DNAPL migration is not observed NW Natural understands that DNAPL management will be fully addressed in the upland FS. *DEQ agrees with NWN that an essential element of designing the HC&C along the disputed portion of Segment 1 is a monitoring program which evaluates the system performance & effectiveness..., including assessing DNAPL movement over time. NWN indicates a monitoring program proposal has already been submitted to DEQ for this purpose & understands DEQ will provide specific revisions to supplement or modify that program. DEQ believes this item should be one of central topics discussed during the 1/11 meeting. The only monitoring program DEQ is aware of NWN having submitted is included in the Interim Design Report, which did not contemplate the 5/17/10 HC&C re-design concept. Given the current status of the HC&C interim design, DEQ anticipates NWN will update the groundwater source control interim design with the 5/17 re-design concept. The update will include evaluating the performance & effectiveness of HC&C through monitoring the system's hydraulic influence, trends in groundwater data, & DNAPL movement.*
3. NW Natural and DEQ will develop a path forward to complete the Risk Assessment. It is a mutual goal of both NW Natural and DEQ to complete the Risk Assessment in order to expedite the development of the upland FS. This objective will minimize the amount of time the HC&C system operates prior to construction of final remedy, including DNAPL management. NW Natural also strongly believes expediting the upland FS is critical for overall project sequencing required in the broader context of Portland Harbor and the Gasco Sediment Remedy.

NW Natural agrees that technical meetings in January 2011 are crucial for getting the conditions resolved and completing the final design. I also appreciate your acknowledgement of our concerns regarding the current DEQ preference for additional data collection prior to completing the risk assessment. In addition to the technical issues you noted we also are concerned that it has schedule implications that affect the amount of time the HC&C system will operate before the upland FS can be prepared. Having said that, NW Natural agrees to be open to the DEQ request for additional data collection and the attendant schedule impacts, with the understanding that DEQ will consider our concerns before making a final decision.

If I have captured the concept we discussed accurately NW Natural is prepared to moved forward with this resolution to the dispute. If you think we should further discuss and clarify any of the elements of the agreement before finalizing the process please let me know.

Jim, I appreciate your efforts on this challenging issue and am looking forward to collaboratively reaching the major milestone of implementing source control at Gasco.

Bob

**From:** ANDERSON Jim M [ANDERSON.Jim@deq.state.or.us]
**Sent:** Wednesday, December 15, 2010 4:21 PM
**To:** Wyatt, Robert
**Cc:** BAYUK Dana; DECONCINI Nina; PEDERSEN Dick
**Subject:** 12/13/10 Gasco Dispute Mtg

Bob,
Thanks for meeting with me Monday morning. The purpose of this e-mail is to summarize DEQ's proposal regarding HC&C & capture the important agreements we reached during our 12/13/10 meeting. I understand you discussed our meeting with Margaret K, & she was..., at least initially..., supportive of our agreements. During our meeting, I indicated DEQ is willing consider modifying our direction to NWN (made 6/11/10 by e-mail) which defers evaluation HC&C along the portion of shoreline Segment 1 where DNAPL occurs to the uplands FS. To us, this is the central issue being disputed. As an alternative to DEQ's 6/11 direction, I proposed that NWN incorporate HC&C along the disputed section of shoreline Segment 1 into the final groundwater source control design document. In other words, in addition to completing the design of HC&C along the southern portion of Segment 1 on the Siltronic property & all of the shoreline Segment 2 on the Gasco site..., NWN would have the opportunity to include the disputed portion of Segment 1 in the final source control design documents (i.e., not defer evaluation of HC&C along the disputed portion of shoreline Segment 1 to the uplands FS.
I presented 3 conditions for my proposal:
1) Technical issues with HC&C along the disputed portion of shoreline Segment 1 must be addressed during final design.
2) NWN must agree to a scope & schedule for completing the Gasco site risk assessments & move into the uplands FS as soon as practicable.
3) The uplands FS must fully evaluate remedial action alternatives for DNAPL associated with former tar ponds area(s), including actions such as barrier walls, removal, solidification/stabilization, etc.
We also discussed the next steps to moving source control final design & the risk assessments forward as follows:

Step 1- NWN decides whether to accept this proposal (due ASAP).
Step 2- DEQ/NWN schedule a manager/technical staff meeting in 1/11 to review the status of groundwater source control, discuss the issues with HC&C along the disputed portion of Segment 1, & talk about the content of the groundwater source control final design document.
Step 3- DEQ/NWN schedule manager/technical staff meeting in 1/11 to discuss the path forward for completing the risk assessments.

Regarding Step 3, as I indicated during our 12/13 meeting, in addition to allowing NWN to evaluate uplands DNAPL removal & the vertical barrier in the uplands FS, DEQ believes we are making another significant concession by allowing NW to include HC&C along the disputed section of shoreline Segment 1 in the source control final design document. Although I understand your concerns regarding DEQ's approach to completing the risk assessments (e.g., collecting samples for TPH fractions analyses) & whether it will help us make better cleanup decisions..., we expect NWN to be open to accepting DEQ's recommendations made in the interest of finishing a complete risk assessment that supports the upland FS.

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