State of Oregon
Department of Environmental Quality **Memorandum**

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To: DEQ Northwest Cleanup Section file

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Subject: Potential for Site-Related EDB Contamination to Groundwater
Townsend Farms
ECSI # 4230

Introduction

This memorandum presents DEQ's interpretation of information regarding the source of ethylene dibromide (EDB) contamination in groundwater that has been detected in the Fairview, Oregon area, including City of Fairview municipal water supply wells. One potential source of contamination is releases from the Townsend Farms property ("Site") located in north Fairview and north of NE Sandy Blvd. Townsend Farms has worked in the past with DEQ's Voluntary Cleanup Program. In addition, lots owned by the Townsend Farms have in the past been purchased and current owners have obtained no further action determinations through DEQs' prospective purchaser (PPA) program. An ongoing concern to DEQ is the potential for contaminant releases at or associated with the Site that have caused or contributed to EDB contamination in area wells.

DEQ has considered multiple lines of evidence to understand the origin, occurrence, and transport of EDB in groundwater in the vicinity of production wells at Townsend Farms and the City of Fairview municipal water supply production wells. The results of DEQ's analysis is presented herein.

Evaluation of EDB in regional groundwater

During a meeting with DEQ staff and Site representatives Mike Townsend and Kerry Rea on October 17, 2017, Mr. Townsend advised that cane fruit (berry) production was a regional industry and that this industry commonly used brominated fumigants as a soil treatment measure. Because of this, Mr. Townsend contended that EDB in groundwater is a regional problem.

To evaluate this contention, DEQ reviewed many groundwater data sets for water supply and monitoring wells in the region of Townsend Farms, from public and private sources. In summary, DEQ found EDB detections in area groundwater to be limited to Townsend private supply wells #2 (currently not in use) and #3 (in use), and Fairview municipal production wells

#5, #6 (and possibly #9[1]). DEQ did not find evidence of a widespread EDB problem in groundwater in East Multnomah County.

Information on the detection (or lack thereof) of EDB in area wells is summarized below.

Regional well data reviewed by DEQ

Well ownership	EDB detected?	Data source
Fairview, City of (#5, #6)	Yes	Oregon Health Authority
Townsend Farms (#3 (EP-A))	Yes	Oregon Health Authority
Troutdale, City of (#2,#3, #4, #5, #6, #7, #8)	No	Oregon Health Authority
Wood Village, City of (#1, #2, #3, #4)	No	Oregon Health Authority
Rockwood PUD (EP-A, B, C)	No	Oregon Health Authority
West Interlachen Coop	No	Oregon Health Authority
Interlachen PUD (#1, #2, #3, #4)	No	Oregon Health Authority
Boeing (420 data sets, many wells)	No	Landau Associates
PWB (21 production wells)	No	Oregon Health Authority
PWB monitoring well PMX 196 (3 nested)	No	Portland Water Bureau
PWB monitoring well #5 (2 nested, North of) Townsend Business Park)	No	Portland Water Bureau
PWB monitoring well #4 (3 nested) (NW corner of Townsend Business Park)	No	Portland Water Bureau
Gresham, City of	EDB not tested	Oregon Health Authority
Wood Village Mobile Home park	EDB not tested	Oregon Health Authority

From the data above, it appears that if EDB were used regionally as an agricultural pesticide, it did not adversely affect groundwater resources on a regional scale.

In standard practice (California Department of Agriculture, 1985) EDB was applied as a liquid or gas to fumigate subsurface agricultural soils for pests purposes prior to planting. Following EDB injection into the upper foot of soils, farmers may place tarps or plastic film on treated fields to limit loss by volatilization and increase residence time in treated soils. Application rates ranged from 50 to 400 pounds per acre. Under this type of agricultural use, the California Department of Agriculture reported some EDB impacts to groundwater.

In the Fairview, Oregon region, if EDB had been administered widely in this manner, it did not widely affect regional groundwater. A point-source leak from a container of liquid EDB pesticide released directly onto the ground or a field with an over-application of EDB could account for localized EDB contamination to groundwater found in Townsend Farms and City of Fairview production wells.

[1] DEQ found analytical data indicating EDB detections in composite (combined) groundwater samples from Fairview wells #5 and #9. DEQ cannot conclude if EDB is present in individual wells or in both wells.

Additional findings:

- The specific gravity of EDB is 2.17 (NIOSH 2007), it is more than twice as dense as water, it is slightly water-soluble, and it has limited affinity (adsorptive capacity) to clay and organic material in water-saturated soil (DEQ 2010). These factors encourage the downward vertical migration of EDB contamination from soil to groundwater, and once within groundwater, continued downward and lateral spread, when released in liquid form.

- The Soil Organic Carbon-Water Partitioning Coefficient (KOC) for EDB is 44 ml/g (in comparison, the KOC for PCE is 364 ml/g; the KOC for Benzene is 83ml/g). Lower KOC values correlate to more mobile organic chemicals in groundwater (DEQ 2010).

- Documents prepared by Evren NW (2016) and Rapid Soil Solutions (2015) for Townsend Farms and the Townsend Business Park have concluded that the groundwater flow direction in unconfined and confined potable aquifers in the vicinity of Townsend Farms is from south to north. DEQ disagrees with these findings, which appear to result from pre-groundwater withdrawal flow assumptions or a misunderstanding of aquifer dynamics during prolonged heavy groundwater pumping. While the "natural" groundwater flow direction is expected to be northerly, under the influence of gravity, DEQ finds that during high-volume groundwater withdrawals in East Multnomah County, groundwater is largely replenished by the Columbia River resulting in a general north-to-south groundwater flow pattern.

  In aggregate, City of Fairview production wells are capable of withdrawing over 1.5 million gallons of water per day. Fairview and several other high-capacity pumping centers overwhelm older, gravity-based flow models and hydraulic head assumptions as were used by Evren NW and Rapid Soil Solutions documents prepared for Townsend Farms.

- Townsend Farms production well #3 is constructed with well casing perforations from 205 to 245 feet below ground surface (bgs), and has a continuous gravel pack from 155 to 260 feet bgs. The total depth of the well is 260 feet bgs. All Townsend and Fairview EDB-containing wells are screened in the Sand and Gravel Aquifer (SGA) (as interpreted by GSI, 2017). As constructed, Townsend well #3 may provide a conduit for the vertical migration of EDB from the Troutdale Sandstone Aquifer (TSA) downward to the deeper SGA aquifer via the long gravel pack surrounding the well. This gravel pack appears to fully penetrate/breach the hydrogeological unit known as Confining Unit (CU2). CU 2 is an important regional confining unit which, in general, provides hydraulic isolation between the TSA and underlying SGA. Given the large quantities of water produced by the Townsend #3 well (100,000 to 300,000 gallons per day) and what appears to be penetration of the confining unit, a contaminant release in the vicinity of the Townsend #3 well may allow migration of EDB to the deeper (SGA) aquifer.

- Townsend Farms is a likely source of EDB contamination to groundwater based on well concentration trends. Townsend #3, Fairview #6 and Fairview #5 show a higher-to-lower trend in EDB concentrations, which suggests that Fairview #3 is closest to the EDB source. These three wells are approximately 1200 feet from each other along a NE-to-SW trending line.

- Pesticide mixing building. Former DEQ project manager Bob Williams indicated via telephone in December 2017 that he made field and photo observations of a pesticide storage and mixing shed near the Townsend #2 and #3 wellheads. This needs to be investigated further to understand if this is the source of EDB contamination in Townsend and Fairview groundwater production wells.

- DEQ observed that the Townsend #2 and #3 well heads are 10 to 15 feet apart.

- The persistent pond at the NE corner if the Townsend Business Park appears to be an expression of the shallow water table (not a confined aquifer) and may be a factor in the transmission of pesticides to deeper groundwater. This pond may need to be further investigated if no other pesticide source is found.

- Fairview wells #5 and #6 are in close hydraulic communication within the SGA confined aquifer despite the 1200 foot distance between the wells. Figure 3 (below) illustrates the nearly coincident response in hydraulic head at Fairview #6 in response to rapid drawdown pumping in Fairview #5. This illustrates the high permeability of the SGA aquifer and the vulnerability to rapid transmission of contaminants.

  Townsend #3 is 1300 feet from Fairview #6 and would be expected to exhibit a similar response to rapid drawdown pumping in Fairview #6.

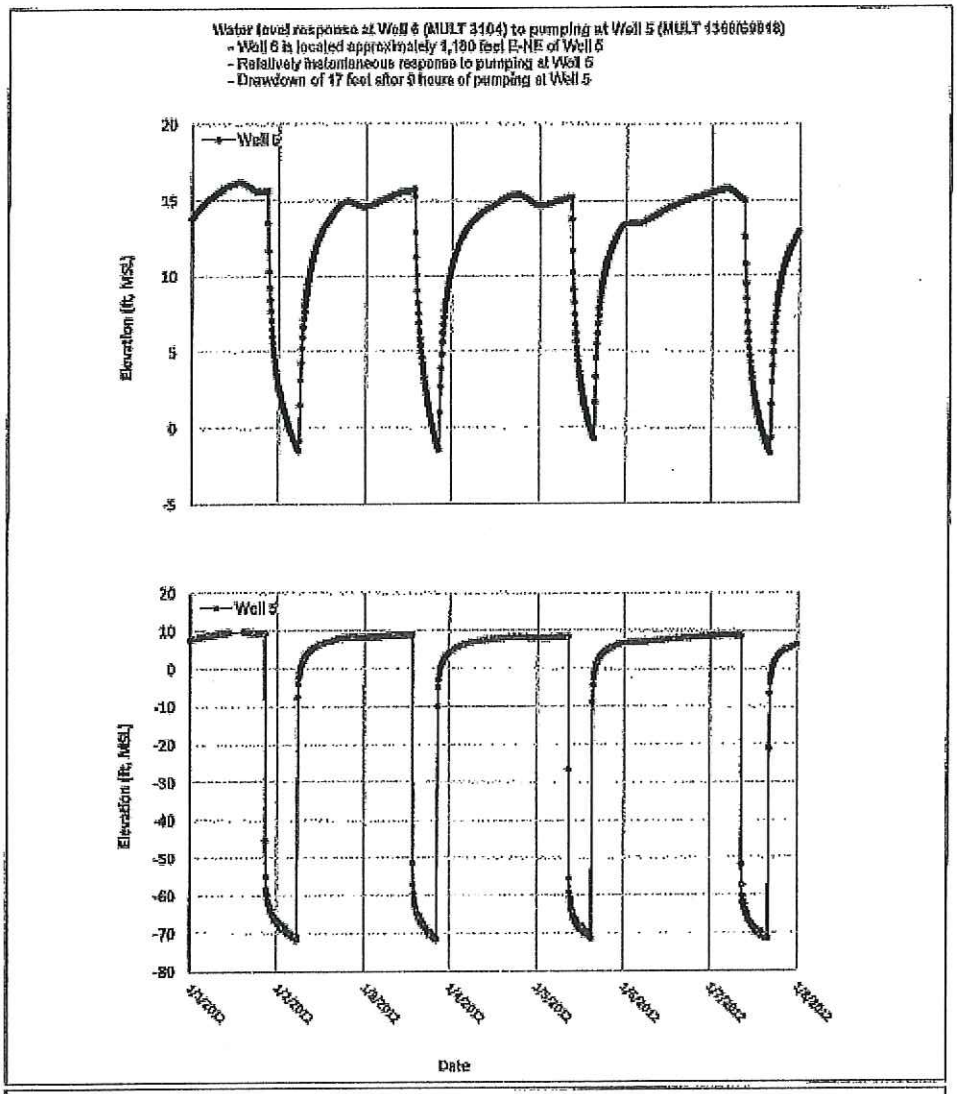

FIGURE 3

Fairview Well 6 Response to Pumping at Well 5
City of Fairview Water Rights Support

- Based on information presented in this memorandum, and referenced documents reviewed by DEQ, DEQ concludes that Townsend Farms historical activity is a probable source of EDB contamination detected in Townsend Farms wells and in nearby City of Fairview wells. Additional investigation is necessary to assess and remediate, or mitigate this source which is impairing the beneficial use of a public drinking water supply.

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