ROBINSON & NOBLE, INC.
GROUND WATER & ENVIRONMENTAL GEOLOGISTS
ESTABLISHED 1947

CRITICAL AQUIFER RECHARGE AREA REPORT
for
ACE PAVING

February 1999

By

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CRITICAL AQUIFER RECHARGE AREA REPORT
ACE PAVING
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Introduction

Ace Paving has made application to Jefferson County (the County) for a permit to construct an asphalt batch plant in the Shine Pit, located in the SW ¼ of the SW ¼ of Section 32, Township 28 North, Range 01 East, Willamette Meridian, Jefferson County (Figure 1). The site is roughly four miles south of Port Ludlow and eight miles east-northeast of Quilcene. The site itself is approximately one-half acre (21,780 square feet) in size and is located entirely within the boundaries of Shine Pit, an active sand and gravel mining operation run by Fred Hill Materials. Site access is via Rocktogo Road, a private gravel road, on the south side of State Highway 104 just west of milepost 10.

This site is located within an area of Vashon recessional and advance outwash, and therefore falls under Section 7.301 of County's Critical Areas Ordinance (CAO). As such, Robinson & Noble, Inc. was retained to perform a DRASTIC assessment of the proposed asphalt batch plant site (hereafter referred to as the Site). This review was accomplished and resulted in a DRASTIC index of 149 (Robinson & Noble, Inc. letter report dated August 19, 1998; presented as Appendix A), below the index of 180 that defines Susceptible Aquifer Recharge Areas according to the County's CAO, Section 11.502. Such an index value would, in most instances, indicate that no further investigation be required under the CAO. However, during Jefferson County Planning's review of the DRASTIC assessment, concerns were raised regarding the lack of site specific hydrogeologic data upon which the DRASTIC assessment was based. There were also additional concerns regarding site drainage and potential impacts to surface water bodies (Beale, 1998). Therefore, the County has requested a Critical Aquifer Recharge Area (CARA) Report consistent with Section 11.50 of the CAO be prepared for the proposed Site. The report is required to contain seven elements described in Section 11.502 of the ordinance. These elements are presented below.

Element 1: Description of Proposed Construction and Activities

Element 1 of Section 11.502 requires a detailed description of the project, including all activities that have the potential for contaminating ground water. The proposed asphalt batch plant will be used to combine hot, liquid asphalt, brought on site by truck, with gravel mined at the Shine Pit and purchased from Fred Hill Materials. The plant will produce hot-mix, a material used primarily for road surfacing. The Site is located entirely within the bounds of the Shine Pit, an active sand and gravel mining operation run by Fred Hill Materials on land leased from Pope Resources. The plant itself will be modular in nature, with a total footprint of approximately one-half acre (21,780 square feet). All stages of the

operation will be located upon concrete or asphalt pads, engineered to provide for the controlled routing and detention of accidental spills and stormwater runoff. As most of the required gravel will be obtained onsite from Fred Hill Materials, truck traffic will be limited to bringing in hot asphalt and removing hot mix. Therefore, the location of the asphalt batch plant is expected to increase truck traffic by 40 to 60 trips per day into the Shine Pit.

The production of hot-mix is a relatively straightforward process. Aggregate, stored in "cold" bins, is delivered to a dryer (via a conveyor belt) to remove any moisture. Dust and exhaust fumes (from the combustion of LP gas) are collected and sent to the "baghouse" where the air is filtered. The dry gravel is lifted, via another conveyor belt in the tower ("hot elevator"), to a screening unit that separates the aggregate by size. The aggregate is then temporarily stored in "hot" bins. Next, appropriate proportions of each aggregate size are weighed out and combined in a mixing unit or pugmill. The final step involves mixing hot, liquid asphalt with the aggregate. The resulting hot-mix is then delivered directly into waiting haul vehicles or sent via a conveyor system to a temporary storage silo for subsequent loading. When a batch plant is operational, a batch of hot-mix can often be produced in less than a minute, and is, therefore, generally produced on demand.

No water is used, or required, in the production of hot-mix. As proposed, stormwater generated from the impervious cement/asphalt pad will be collected and detained on-site, treated using an oil-water separator, and then routed to the existing gravel washing pit operated by Fred Hill Materials. This water will mix with existing water in the wash pit and eventually either evaporate after being used to wash gravel, or run into an overflow pit and infiltrate to the groundwater system. Water routed to this overflow pit is monitored by Fred Hill Materials employees for compliance with groundwater discharge requirements. The oil-water separator will be maintained by Ace Paving employees.

The potential for the proposed activities to contaminate ground water in the area is low. Not only are the physical location and the hydrogeologic setting (discussed below) of the Site favorable, the proposed activities and associated materials themselves generally present a low potential for contamination. The most abundant material on-site, aside from the native sand and gravel, will be asphalt. At ambient temperatures, asphalt is a solid substance. In order to facilitate its mixing with gravel at the batch plant, the asphalt is heated to the point at which it becomes a slow-moving liquid. Should an accidental release of liquid asphalt or hot-mix occur, whether within or beyond the concrete/asphalt pad, the material will quickly congeal allowing for the complete recovery of all released material.

The asphalt batch plant itself will operate using compressed liquid propane (LP) fuel. This fuel is a gas at atmospheric pressures. If any of this fuel were accidentally released, it will rapidly vaporize, presenting little opportunity for infiltration to occur and eliminating any risk to the local groundwater system. A 500-gallon, above-ground diesel tank will also be located on Site to provide a fuel reserve for plant generators. Additionally, a small quantity of detergents, solvents, oils, and greases will be kept on-site for general equipment maintenance and cleaning. As with all materials storage on Site, the diesel tank and other chemical storage will be integrated into the plant's spill prevention plan. The storage

facilities will be located on a concrete/asphalt pad with controlled routing and detention of any spilled material and stormwater runoff. All appropriate Best Management Practices (BMPs) regarding the filling, dispensing, and storage of diesel and other chemicals will be implemented. Therefore, the potential of groundwater contamination from these materials is slight.

Element 2: Hydrologic Evaluation

Element 2 of Section 11.502 requires a hydrogeologic evaluation of the property be performed. This evaluation needs to cover seven specific points providing descriptions of setting, topography, drainage, groundwater characteristics, locations of wells and springs, and evaluations of recharge.

As indicated in the initial DRASTIC evaluation (Appendix A), few groundwater related studies covering, or in the vicinity of, the Site have been performed. Two regional studies (Grimstad and Carson, 1981, and Economic & Engineering Services, Inc., and Pacific Groundwater Group, 1994) both mapped the predominant surface geology of the Site and adjacent areas as a sequence of glacial sediments (Quaternary in age) from the Vashon Stade of the Fraser Glaciation. The Site itself is mapped as recessional outwash, comprised of sand and gravel, which was deposited by meltwater streams as the glaciers receded. As mapped by both the 1981 and 1994 studies, the glacial till typically deposited between the advance and recessional deposits is locally absent or discontinuous. Glacial till is a poorly sorted mix of clay, silt, sand, and gravel deposited at the base of a glacier and subsequently compacted by the glacier's weight. Both studies indicate the presence of advance outwash, beneath the recessional outwash and till, if present. This advance outwash is predominantly sand with some gravel, deposited as the glaciers advanced into the area. Both regional studies grouped sediments below the advance deposits and overlying Tertiary bedrock as undifferentiated Quaternary deposits.

A more localized groundwater study (Robinson & Noble, 1992), centered on the Shine area two miles east of the Site, indicates a similar sequence of glacial sediments, but further subdivides the materials beneath the advance deposits. This study also indicates a thin and discontinuous till layer. According to this local study, which has better well control than the regional studies, the advance materials are underlain by Vashon lacustrine deposits (Qvl--glacial), Quaternary Whidbey Formation (Qw--non-glacial), Quaternary Double Bluff Drift (Qdb--glacial), and Tertiary volcanics (Tv--bedrock). Of these lower units, only the Double Bluff Drift, known to the north of Shine as the Port Ludlow South Aquifer (Robinson & Noble, 1992), is used for water production.

On February 12 and 13, field visits were performed to gather site specific information regarding the surface geology, aquifer characteristics, groundwater flow gradient and direction, and current drainage characteristics. As previously mentioned, the Site is located within an active sand and gravel mining operation and Site topography has been extensively

modified from its pre-mining state shown on U.S. Geological Survey topographic maps (Port Ludlow and Lofall 1:24,000 quadrangles) and soil survey photographs. During these visits, a pumping test was made on the Fred Hill Materials Shine Pit well. Additionally traverses of the area were made to map locations of springs and other water features.

Element 2a: Regional Hydrogeologic Setting

In order to import the results of the 1992 Shine study into the current project area, all well logs cataloged with the Department of Ecology for the 16 sections surrounding the Site were collected and analyzed. These well logs were used to extend a cross-section from the 1992 study into the Site area. This cross-section is presented as Figure 2.

The previous studies, as well as the present work, found that there are generally two units in the region used for groundwater production: the Vashon advance outwash and the Double Bluff Drift. The two units are separated by a very thick confining layer formed by the Vashon lacustrine deposits and the Whidbey Formation. The extension of the lacustrine deposits, the Whidbey Formation, and the Double Bluff Drift into the Site area has not been proven due to a lack of deep well drilling in the area, but their existence beneath the advance outwash in the area is very probable.

Recharge to the aquifers of the region is the result of local precipitation infiltrating through surficial materials. Discharge from the Vashon outwash aquifer is via wells, spring discharge along hillsides, or through evapotranspiration. Discharge form the deep aquifer (Double Bluff) is through wells or springs and leakage to Hood Canal. In the Shine area, the majority of both domestic and purveyor wells produce water from the deep aquifer. A few domestic wells also produce from the advance outwash aquifer. There are no known wells in the Vashon recessional outwash. For additional discussion on the "local" regional hydrogeology, the reader is referred to the 1992 Shine area study.

Element 2b: Site Location, Topography, Drainage, Geology, and Surface Water

The pit area containing the Site is located on a portion of a ridge that runs roughly north south along the margin of a bluff that overlooks Squamish Harbor to the east. The thin veneer of recessional gravel, which originally was the surficial geologic unit in the area, has been removed from the portion of the pit where the site is located. The overall current topography of the pit area can best be described as relatively level to rolling, sloping slightly to the west and into the hill. The general Site area has occasional "steps" separating mining activities at different elevations. Drainage in the area is internal such that areas still covered with gravel and exposed portions of the advance outwash serve to infiltrate precipitation, and areas where clay/till is at surface generally route water towards the gravel washing pit in the northwest portion of the pit. Precipitation falling on the eastern side of the north-south ridge, upon which the Site is located, likely drains to the east down the bluff. Where till is present at the surface, water will collect into various small ephemeral stream channels. Where advance outwash is present at surface, the water may infiltrate until it reaches the

water table which discharges along a spring line. At the spring line, water discharges to surface again, ultimately running into Shine Creek before reaching Squamish Harbor.

The only surface water body in the immediate area is the settling pond in the gravel-washing pit. This small pond is not a natural feature. Its presence is due to its location on glacial till and the constant influx of water used to wash gravel. In addition, pit employees add a flocculent to the water leaving the gravel washing apparatus causing fine-grained material to settle out of the water onto the ponds base, further reducing infiltration losses.

Element 2c: Soils and Geologic Units

Everett gravelly, sandy loam and Hoypus gravelly, loamy sand are mapped for the Site area in the Soil Survey of Jefferson County Area, Washington (U.S. Soil Conservation Service, 1975). However, these soils have been removed or disturbed as part of the mining process. In fact, no outcrops of undisturbed surficial material are available in the immediate proximity of the Site and the area has likely undergone significant compaction as a result of mining activities. In the vicinity of the Site, it appears that the material currently at land surface is a relatively thin layer of glacial till, underlain by compact advance outwash deposits composed predominantly of medium to coarse sand. However, according to the Shine Pit manager John Van Hulle, when gravel was removed from the area immediately to the west of the Site, no clay (glacial till) was encountered. Rather, the material changed abruptly from gravel to a compact coarse sand with only minor quantities of gravel. Indeed, surficial material in this area, though also highly compacted as a result of mining activities, is much less clay-rich than further east and appears to be composed of advance outwash deposits.

The presence or absence of a glacial till, if present, can be significant to the overall hydrogeology of a site. By impeding the downward movement of water, glacial till can support a perched aquifer system, particularly during the wet, winter season. However, there is no evidence of a perched aquifer system in the area. Also, the till can act as a confining layer and provide additional contamination protection for deeper aquifers. The only well located within this section (the Fred Hill Shine Pit well—attached as part of Appendix A) does indicate a thin zone of "hardpan" at a depth of 30 to 35 feet, which may possibly be glacial till or alternatively may be a clay and gravel zone within the advance outwash. However, the materials overlying this unit are not indicated as water bearing, despite the fact that the well was drilled during February, a typically wet month throughout Puget Sound. This suggests that the glacial till in this area is thin, discontinuous, and unlikely to support a significant perched aquifer system. This conclusion is supported by other observations. Mining, both near the Site (as described above) and north of the Site reportedly found recessional outwash directly overlying advance outwash. Regional geologic mapping (also described earlier) also found a lack of till.

The soils and geologic units underlying the Site can be summarized as follows. No natural soils remain on the Site or the surrounding pit area. Surficial materials are compacted

recessional outwash (highly gravelly), advance outwash (less gravel more sand), or in a few places glacial till (clay-rich gravel). In the Site area itself, part of the surface material is clay-rich and part not. Three geologic units are confirmed to be in the area: recessional and advance outwash, and a discontinuous, thin till. Beneath the advance outwash, a clay-rich lacustrine unit probably exists.

Elements 2d and e: Ground Water, Well, and Spring Characteristics

During the site visit on February 13, a 2-hour constant rate test was performed on the Fred Hill Shine Pit well in order to determine aquifer characteristics. This well is located approximately 400 feet west of the Site. No other wells were found, or are known to exist, nearby in which observations could be made. Drawdown and recovery graphs for the pumping well are presented as Figures 3 and 4, respectively. Prior to test, the well had been dormant for approximately 16 hours and the static water level in the well was 61.54 feet BTC (below the top of casing). Pumping was initiated at a rate of 36 gallons per minute, as measured at a water meter installed on the well's discharge line. After the start of pumping, the water level declined rapidly to approximately 70 feet below top of casing (a drawdown of six-and-a-half feet) where it stabilized for the remainder of the test (Figure 3). The pump was turned off after two hours of production. The water level in the well recovered slowly for the first two minutes after pump shutdown due to a siphoning effect in the discharge line (Figure 4). After approximately two-and-a-half minutes, when suction in the discharge line was broken, water was able to freely enter the well and the water level quickly rose to approximately 62.5 feet BTC. Recovery during the remainder of monitoring was steady and predictable. The transmissivity of the aquifer, as determined from the recovery plot, is 27,000 gpd/ft^2 (gallons per day per foot squared).

During the field visits, the area within several thousand feet of the Site was canvassed to locate wells and springs. No wells were found, and no springs were located within 1,000 feet of the Site. However, three springs were located east and below the Site at approximate distances of 1,500 to 2,000 feet. These spring locations are shown on Figure 1. These springs exist as numerous small seeps which collectively discharge at flow rates estimated to be 50 to 100 gpm. These springs are believed to represent discharge point for the advance outwash aquifer, occurring at or near the base of the aquifer.

Altimeter surveys were performed to determine the elevation of the well relative to the springs (and to surveyed road intersections indicated on the USGS topographic maps). The survey found the water level in the well to be 259.5 feet above MSL (mean sea level), and the elevation of the springs range from 155 to 171 feet above MSL. This implies that the depth to the water table beneath the Site is currently about 100 feet. The elevations of these springs and of the static water level in the well allowed an approximate flow direction and gradient to be calculated. This data indicates that flow direction is almost due east towards Squamish Harbor (as was initially suggested by a cursory potentiometric map constructed for the area as part of this investigation). Because the water surface from the position of the well to the spring line is convex-up in nature and not straight, the straight-

line gradient (0.05) calculated from this elevation data represents an upper-bound estimate of gradient. However, due to the lack of other wells in this area, this straight-line gradient was used in the analytical flow model discussed below.

On February 12, water samples were collected from the well and submitted to Water Management Labs for inorganic, bacterial, and volatile organic compound (VOC) analyses (Appendix B). All aspects of the water quality meet the Department of Health's water quality standards. An additional sample, analyzed in our in-house lab, confirms these findings. The water appears to be free from current contamination.

Element 2f and g: Groundwater Recharge

Recharge to the groundwater system can be determined by taking the amount of water imported to the system (i.e., precipitation) and subtracting that amount of water that is exported from the system (i.e., evapotranspiration and runoff). The 1994 Economic & Engineering Services and Pacific Groundwater Group (EES/PPG) study estimates annual recharge for the Site area to be 15 to 20 inches per year based upon assumptions of typical evapotranspiration and runoff for the region. Given the lack of soil and vegetation across the majority of the pit area and the predominantly internal drainage of the pit area, this recharge estimate likely represents a lower-bound estimate for the Site. An upper-bound estimate of recharge to this area can be obtained directly from the long-term average precipitation. Recharge occurs from precipitation after the demands of evaporation, transpiration and runoff are satisfied. In this case, there will be little to no transpiration because the pit area is largely devoid of vegetation. Evaporation will be minimal because most precipitation occurs during the winter months. Runoff is minimal because of the permeable nature of much of the area. The runoff that does occur is internal, with pond overflow infiltrating (as recharge).

A U.S. Weather Bureau map (U.S. Weather Bureau, 1965--presented in the 1994 EES/PPG study) presents an isohyetal map of the long-term (1930-1957) mean annual precipitation for eastern Jefferson County. This map indicates that the Site receives approximately 33 inches of precipitation per year. More recent (incorporating data through 1998) long-term mean annual precipitation calculations (Robinson & Noble, Inc., 1999) indicate that the long-term mean annual precipitation for the Site is more appropriately 38 inches per year. Assuming small evapotranspiration losses, the recharge is possibly greater than 30 inches per year on average.

The proposed facility uses no water in the production of hot-mix. As proposed, the asphalt batch plant will collect and route stormwater to the existing settling pond in the gravel washing pit. Water entering this pond is either evaporated or, in times of peak flow, infiltrated into the subsurface via the overflow pits. Because of the small size of the impermeable area within the project (one-half acre) and the fact that some of the runoff from this area will still ultimately be recharged through infiltration, the project will have essentially no impact on the amount of recharge to the aquifer.

occur, plant employees will contact either Jefferson County Planning or Environmental Health Department staff and submit a spill response report documenting the quantity and type of materials spilled, and response procedures implemented. Land surface in the immediate proximity of the Site is relatively impermeable due to the presence of glacial till, however the plant and its employees will exercise spill prevention methodologies consistent with the Puget Sound Stormwater Manual Best Management Practices (BMPs).

Elements 4 and 7: Cumulative Impacts and Monitoring Program

Element 4 deals with cumulative impacts to groundwater quality. This proposed land use should have no impact to water quality, cumulative or otherwise. Element 7 deals with a water quality monitoring program. Stormwater runoff from the Site will be directed to the present gravel-wash pit. Fred Hill Materials currently operates a monitoring program for this wash pit, and runoff from the Site will be handled under this current program.

Conclusions

The proposed Ace Paving asphalt batch plant to be located within the Shine Pit operated by Fred Hill Materials should have no impact to local ground water. The proposed location does overlie a water table aquifer, which exists within Vashon advance outwash sediments. However, there is only one known user of this aquifer, that is Fred Hill Materials which maintains a well for wash water in the aquifer. No domestic residences were found in the area.

The batch plant should have a negligible effect on groundwater quantity. Though the plant is to have an impermeable footprint, stormwater runoff from the plant will be routed to the gravel wash pond where some of it will infiltrate anyway. Additionally, the small size of the plant itself precludes any significant impact, particularly in a regional sense since the plant is to be located in an area of enhanced (above natural levels) recharge due to the stripping of vegetation and soils by the gravel mining.

The batch plant should have no impact to groundwater quality. The main materials to be used by and produced from the plant do not present a contamination hazard. Small amounts of diesel fuel and solvents will be stored on the site; however, if accidentally spilled, they should be detained by the stormwater capture system where they can be cleaned up. The use of BMPs will further prevent contamination events. In the unlikely event contamination does reach the aquifer, modeling indicates it will discharge to the surface several thousand feet east of the site where most the contaminated water should be consumptively used by natural vegetation.

REFERENCES

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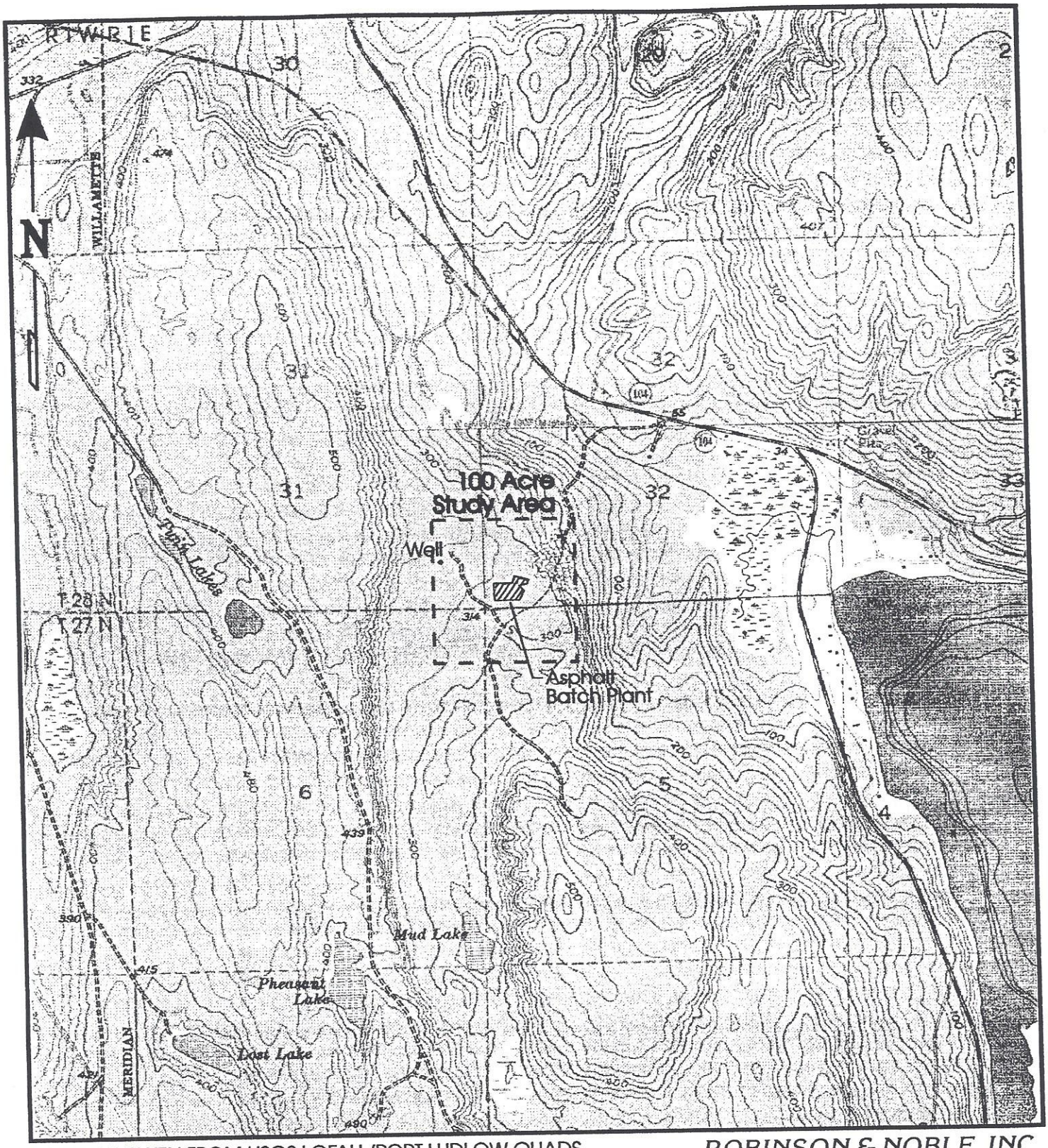
FIGURE 1



BASEMAP TAKEN FROM USGS LOFALL/PORT LUDLOW QUADS

ROBINSON & NOBLE, INC.

SITE LOCATION MAP

SCALE 1: 24,000

KITSAP COUNTY

Ace Paving

se Print Plainly
HEAVY PEN
NOT WRITE IN SHADED AREAS

WATER MANAGEMENT LABORATORIES INC.
1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

FOR INSTRUCTIONS

INORGANIC CHEMICALS (IOCS) REPORT

ystem ID No: NA	System Name: Shine Pit		
ab/Sample No: 08936828	Date Collected: 2-12-99	DOH Source No: NA	
ultiple Source Nos: NA	Sample Type: B	Sample Purpose: I	
ate Received: 2-12-99	Date Reported: 2-18-99	Supervisor: MP	
ounty: Jefferson	Date Digested: NA	Group: A B (Other)	
ample Location: well spigot			
end Report To: Robinson & Noble 5320 Orchard St W Tacoma WA 98467	Bill To:		

DOH#	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS Trigger?	EXCEEDS MCL?	Method / Analyst	
	EPA REGULATED									
4	Arsenic	<0.01	mg/l	0.01	0.05	0.05	NO	NO	3113B	MP
5	Barium	<0.1	mg/l	0.1	2	2			3113B	MP
6	Cadmium	<0.002	mg/l	0.002	0.005	0.005			3113B	MP
7	Chromium	0.011	mg/l	0.01	0.1	0.1			3113B	MP
11	Mercury	<0.0005	mg/l	0.0005	0.002	0.002			3112B	MP
12	Selenium	<0.005	mg/l	0.005	0.05	0.05			3113B	MP
110	Beryllium	<0.002	mg/l	0.003	0.004	0.004			3113B	MP
111	Nickel	<0.04	mg/l	0.04	0.1	0.1			3111B	MP
112	Antimony	<0.002	mg/l	0.005	0.006	0.006			3113B	MP
113	Thallium	<0.001	mg/l	0.002	0.002	0.002			3113B	MP
116	Cyanide	<0.05	mg/l	0.05	0.2	0.2			4500-CNF	MP
19	Flouride	<0.2	mg/l	0.2	2	4			4110B	MP
114	Nitrite - N	<0.2	mg/l	0.5	0.5	1			4110B	MP
20	Nitrate - N	<0.2	mg/l	0.5	5	10			4110B	MP
161	Total Nitrate/Nitrite	<0.4	mg/l	0.5	5	10	↓	↓	4110B	MP
	EPA REGULATED (Secondary)									
8	Iron	<0.03	mg/l	0.1	0.3	0.3	NO	NO	3111B	MP
10	Manganese	<0.01	mg/l	0.01	0.05	0.05			3111B	MP
13	Silver	<0.01	mg/l	0.01	0.1	0.1			3111B	MP
21	Chloride	2	mg/l	20	250	250			4110B	MP
22	Sulfate	4	mg/l	10	250	250			4110B	MP
24	Zinc	<0.05	mg/l	0.2	5	5	↓	↓	3111B	MP
	STATE REGULATED									
14	Sodium	7	mg/l	5					3111B	MP
15	Hardness	51	mg/l	10					2340C	MP
16	Conductivity	122	umhos/cm	10	700	700	NO	NO	2510B	MP
17	Turbidity	0.3	NTU	0.1	1		NO		2130B	MP
18	Color	<5	color units	5	15	15	NO	NO	2120B	MP
26	Total Dissolved Solids	82	mg/l	150	500	500	NO	NO	2540C	MSL
	STATE UNREGULATED									
9	Lead	<0.002	mg/l	0.002					3113B	MP
23	Copper	<0.02	mg/l	0.2					3111B	MP

COMMENTS: R+N Special

A 1,2,3

ML 2-18-9

OH#	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS		Method / Analyst	
							Trigger?	MCL?		
	OTHER *(Optional)*									
71	Orthophosphate	NA	mg/l	0.1						
72	Silica	30	mg/l	1.0					4500-Si D	WMA
02	Aluminum	NA	mg/l	0.05						
03	Alkalinity	NA	mg/l	10						
04	Magnesium	4	mg/l	0.1					3500-Mg E	GPS
05	Calcium	13	mg/l	0.5					3500-Ca D	GPS
06	Ammonia	NA	mg/l	1						
	CARBONATE AS $CaCO_3$	0	mg/L						2320	GPS
	BICARBONATE AS $CaCO_3$	59	mg/L						2320	GPS
	POTASSIUM	0.5	mg/L						3111 B	GPS
	pH	7.2	UNITS						4500-H^+	WMA

OTES:

RL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

gger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.

CL (maximum contaminent level): If the contaminent amount exceeds the MCL, immediately contact your regional DOH office.

A (Not Analyzed): in the results column indicates this compound was not included in the current analysis.

D (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.

'0.001): indicates the compound was not detected in the sample at or above the concentration indicated.

COMMENTS:

ML
2-18-99

WATER MANAGEMENT LABORATORIES INC.

1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

VOLATILE ORGANIC CHEMICALS (VOC's) ANALYSIS REPORT
EPA TEST METHOD - 524.2

System ID No. : NA	System Name: Shine Pit Well		
Lab/Sample No. : 08975014	Date Collected : 02/12/99		DOH Source No. : NA
Multiple Source Nos. : NA		Sample Type: B	Sample Purpose : I
Date Received : 02/12/99	Date Reported : 02/18/99	Supervisor :	
	Date Analyzed : 02/16/99	Analyst : WMA	
County : Jefferson		Group : Private	
Sample Location : Well Spigot			
Send To: Robinson & Noble, Inc. 5320 Orchard St. W; Tacoma, WA 98467		Bill To : SAME	

DOH #	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS	
	EPA REGULATED						Trigger?	MCL?
45	Vinyl Chloride	ND	ug/L	0.5	0.5	2	NO	NO
46	1,1 - Dichloroethylene	ND	ug/L	0.5	0.5	7	NO	NO
47	1,1,1 - Trichloroethane	ND	ug/L	0.5	0.5	200	NO	NO
48	Carbon Tetrachloride	ND	ug/L	0.5	0.5	5	NO	NO
49	Benzene	ND	ug/L	0.5	0.5	5	NO	NO
50	1,2 - Dichloroethane	ND	ug/L	0.5	0.5	5	NO	NO
51	Trichloroethylene	ND	ug/L	0.5	0.5	5	NO	NO
52	1,4 - Dichlorobenzene	ND	ug/L	0.5	0.5	75	NO	NO
56	Dichloromethane	ND	ug/L	0.5	0.5	5	NO	NO
57	trans-1,2 - Dichloroethylene	ND	ug/L	0.5	0.5	100	NO	NO
60	cis-1,2 - Dichloroethylene	ND	ug/L	0.5	0.5	70	NO	NO
63	1,2 - Dichloropropane	ND	ug/L	0.5	0.5	5	NO	NO
66	Toluene	ND	ug/L	0.5	0.5	1000	NO	NO
67	1,1,2 - Trichloroethane	ND	ug/L	0.5	0.5	5	NO	NO
68	Tetrachloroethylene	ND	ug/L	0.5	0.5	5	NO	NO
71	Chlorobenzene	ND	ug/L	0.5	0.5	100	NO	NO
73	Ethylbenzene	ND	ug/L	0.5	0.5	700	NO	NO
76	Styrene	ND	ug/L	0.5	0.5	100	NO	NO
84	1,2 - Dichlorobenzene	ND	ug/L	0.5	0.5	600	NO	NO
95	1,2,4 - Trichlorobenzene	ND	ug/L	0.5	0.5	70	NO	NO
160	Total Xylenes	ND	ug/L	0.5	0.5	10000	NO	NO
74	m/p Xylenes (MCL for Total)	ND	ug/L	0.5	0.5		NO	
75	o - Xylene (MCL for Total)	ND	ug/L	0.5	0.5		NO	
	EPA UNREGULATED							
27	Chloroform	ND	ug/L	0.5	0.5		NO	
28	Bromodichloromethane	ND	ug/L	0.5	0.5		NO	
29	Chlorodibromomethane	ND	ug/L	0.5	0.5		NO	
30	Bromoform	ND	ug/L	0.5	0.5		NO	
53	Chloromethane	ND	ug/L	0.5	0.5		NO	
54	Bromomethane	ND	ug/L	0.5	0.5		NO	
55	Chloroethane	ND	ug/L	0.5	0.5		NO	

Lab/Sample No. : 08975014

Water Management Laboratories, Inc.
1515 80th St. E.
Tacoma, WA 98404
(253) 531-3121

DOH #	ANALYTES	RESULTS	UNITS	SRL	TRIGGER	MCL	EXCEEDS	
							Trigger?	MCL?
	EPA UNREGULATED (Continued)							
58	1,1 - Dichloroethane	ND	ug/L	0.5	0.5		NO	
59	2,2 - Dichloropropane	ND	ug/L	0.5	0.5		NO	
62	1,1 - Dichlroropropene	ND	ug/L	0.5	0.5		NO	
64	Dibromomethane	ND	ug/L	0.5	0.5		NO	
70	1,3 - Dichloropropane	ND	ug/L	0.5	0.5		NO	
72	1,1,1,2 - Tetrachlroroethane	ND	ug/L	0.5	0.5		NO	
78	Bromobenzene	ND	ug/L	0.5	0.5		NO	
79	1,2,3 - Trichloropropane	ND	ug/L	0.5	0.5		NO	
80	1,1,2,2 - Tetrachloroethane	ND	ug/L	0.5	0.5		NO	
81	o - Chlorortoluene	ND	ug/L	0.5	0.5		NO	
82	p - Chlorotoluene	ND	ug/L	0.5	0.5		NO	
83	m - Dichlorobenzene	ND	ug/L	0.5	0.5		NO	
154	1,3 - Dichlororopene	ND	ug/L	0.5	0.5		NO	
	STATE UNREGULATED							
65	cis-1,3 - Dichloropropene	ND	ug/L	0.5	0.5		NO	
69	trans-1,3 - Dichloropropene	ND	ug/L	0.5	0.5		NO	
85	Fluorotrichloromethane	ND	ug/L	0.5	0.5		NO	
86	Bromochloromethane	ND	ug/L	0.5	0.5		NO	
87	Isopropylbenzene	ND	ug/L	0.5	0.5		NO	
88	n - Propylbenzene	ND	ug/L	0.5	0.5		NO	
89	1,3,5 - Trimethylbenzene	ND	ug/L	0.5	0.5		NO	
90	t - Butylbenzene	ND	ug/L	0.5	0.5		NO	
91	1,2,4 - Trimethylbenzene	ND	ug/L	0.5	0.5		NO	
92	s - Butylbenzene	ND	ug/L	0.5	0.5		NO	
93	p - Isopropylbenzene	ND	ug/L	0.5	0.5		NO	
94	n - Butylbenzene	ND	ug/L	0.5	0.5		NO	
96	Napthalene	ND	ug/L	0.5	0.5		NO	
97	Hexachlorobutadiene	ND	ug/L	0.5	0.5		NO	
98	1,2,3 - Trichlorobenzene	ND	ug/L	0.5	0.5		NO	
102	EDB (Confirm by 504.1)	ND	ug/L	0.5	0.5		NO	
103	DBCP (Confirm by 504.1)	ND	ug/L	0.5	0.5		NO	
162	Dichlorodifluoromethane	ND	ug/L	0.5	0.5		NO	

NOTES:

SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.

MCL (Maximum Contaminant Level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.

NA (Not Analyzed): In the RESULTS column indicates this compound was not included in the current analysis.

ND (Not Detected): In the RESULTS column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.

< : Indicates less than.

Comments : A level of 100 ug/L total Trihalomethanes (Compounds 27-30) is allowed.

1,2,3

1515 80TH STREET E
TACOMA, WA 98404
~~(253)~~ 581-3121

W. ER BACTERIOLOGICAL ANALY S

SAMPLE COLLECTION: READ INSTRUCTIONS ON BACK OF GOLDENROD COPY
If instructions are not followed, sample will be rejected.

DATE COLLECTED MONTH / DAY / YEAR	TIME COLLECTED	COUNTY NAME
2 / 12 / 99	9 : 48 ☒ AM ☐ PM	JEFFERSON Co.

TYPE OF SYSTEM: ☒ PUBLIC ☐ INDIVIDUAL (serves only 1 residence)

IF PUBLIC SYSTEM, COMPLETE: I.D. No. [| | | | | |]

CIRCLE GROUP: A B

NAME OF SYSTEM: SHINE PIT

SPECIFIC LOCATION WHERE SAMPLE COLLECTED (ie, kitchen tap @ school, fire station, fountain): WELL SPIGOT

TELEPHONE NO. DAY (253) 475-7711 EVENING ( )

SAMPLE COLLECTED BY: (Name)

SYSTEM OWNER / MGR.: (Name) JOHN VAN HULLE

SOURCE TYPE ☐ GROUND WATER UNDER SURFACE INFLUENCE
☐ SURFACE ☒ WELL or WELL FIELD ☐ SPRING ☐ PURCHASED or INTERTIE ☐ COMBINATION or OTHER

SEND REPORT TO: (Print Full Name, Address and Zip Code)
ROBINSON & NOBLE, INC.
5320 ORCHARD ST. WEST
TACOMA WASHINGTON 98467

TYPE OF SAMPLE (check only one in this column)

☒ ROUTINE DRINKING WATER check treatment
- ☐ Chlorinated (Residual:___Total ___Free)
- ☐ Filtered
- ☒ Untreated or Other_____

☐ REPEAT SAMPLE
Previous coliform presence Lab #_____
Previous coliform presence Date____/____/____

☐ RAW SOURCE WATER Source # S ☐☐
☐ NEW CONSTRUCTION or REPAIRS
☐ Total Coliform
☐ Fecal Coliform

☐ Other (Specify)_____

REMARKS

LABORATORY RESULTS (FOR LAB USE ONLY)

METHOD USED

MF	MPN	PA	MMO	CPRG

TOTAL COLIFORM _____/100 ml
FECAL COLIFORM _____/100 ml
E. COLI _____/100 ml
HETEROTROPHIC _____/per ml

ANOTHER SAMPLE REQUIRED

SAMPLE NOT TESTED BECAUSE:
- ☐ Sample too old
- ☐ Wrong container
- ☐ Incomplete form
- ☐ _____

TEST UNSUITABLE BECAUSE:
- ☐ Confluent growth
- ☐ TNTC
- ☐ Turbid culture
- ☐ Excess debris

DRINKING WATER SAMPLE RESULTS

☐ UNSATISFACTORY, Coliforms present
REPEAT SAMPLES REQUIRED: ☐ E. Coli present ☐ E. Coli absent ☐ Fecal present ☐ Fecal absent

☒ SATISFACTORY Coliforms absent

SEE REVERSE SIDE OF GREEN COPY FOR EXPLANATION OF RESULTS

LAB NO.	DATE, TIME RECEIVED	RECEIVED BY
0897 8009	2-12-99 3pm 35	TW

DATE REPORTED		ROUTE	ACCT. #
2-16-99			

ROBINSON & NOBLE, INC.
GROUND WATER & ENVIRONMENTAL GEOLOGISTS
ESTABLISHED 1947

August 19, 1998

Scalf

Mr. Al Scals, Planning Director
Jefferson County
621 Sheridan Avenue
Port Townsend, WA 98368

Subject: Application of DRASTIC to the proposed asphalt batch plant, near Port Ludlow, Jefferson County, Washington.

Dear Mr. Scals:

We were asked by Madrona Planning to provide a DRASTIC evaluation for an asphalt batch plant proposed by Ace Paving. The proposed asphalt batch plant is located near Port Ludlow, Washington, in Jefferson County, T. 28 N., R. 1 E., Section 32. The site is approximately 60 acres in size, although for this evaluation, the 100 acres surrounding the site was evaluated (Figure 1).

The site is mapped as Quaternary Vashon recessional outwash, which consists primarily of gravel with some sand, silt and clay (Carson and Grimstad, 1981). The site is currently located within a gravel quarry on a piece of land that is no longer being quarried. The Vashon recessional outwash is assumed to be the unit that has been quarried in this area. Field inspection of the site has shown that underlying the Vashon recessional outwash is the Quaternary Vashon lodgement till, which has a high clay content with some gravel and sand and has been described as hardpan. The lodgement till is the exposed unit on which the plant will stand on. This unit has low permeability. Other studies suggest the till is thin and underlain by Vashon advance outwash at a shallow depth (Economic and Engineering Services, Inc., and Pacific Groundwater Group, 1994).

The DRASTIC evaluation procedure (Aller and others, 1987) provides slightly different evaluations for confined and unconfined aquifers. Based on available data, it is not totally clear whether the aquifer beneath the proposed batch plant site is unconfined. Well logs for a one-mile radius surrounding the plant were collected from the Department of Ecology. Only one well within the hundred-acre study area was found, the Fred Hill Shine Pit Well (well log attached). This log shows water-bearing sand from 85-96 feet and 105-160 feet in depth. Immediately above these units is also sand which was not noted as water-bearing. The reported static water level is 71.25 feet; however, this water level is for the lower of the two water-bearing zones, and a water level is not reported for the upper zone. The nine feet of material separating the two zones is described as sandy clay. Two possibilities exist for

5320 Orchard Street West ▪ Tacoma, Washington 98467 ▪ (253) 475-7711 ▪ Fax: (253) 472-5846
rninc@wolfenet.com ▪ http.//www.wolfenet.com/~rninc

the described situation. First, that the two zones are actually part of the same aquifer, which is unconfined (and the materials between 71 and 86 feet are actually water-bearing, though not noted as such). Or second, that the zones represent two separate aquifers, the upper one being unconfined with a water level around 85 feet and the lower one confined with a water level at 71 feet. Since the site is situated in a hydrogeologic setting in which deeper aquifers typically have lower water levels than upper aquifers, the second possibility is less likely than the first. Additionally, Aller et. al. (1987) state that if an aquifer cannot be determined to be confined or unconfined, it should be treated as unconfined. Therefore, for this DRASTIC evaluation, the aquifer will be considered as unconfined.

Creating a DRASTIC index for a site allows for the evaluation of its relative vulnerability to groundwater contamination. DRASTIC incorporates the following seven factors to characterize possible danger of contamination: depth to water, net recharge, aquifer media, topography, impact of the vadose zone, and hydraulic conductivity.

Depth to Water

The depth to water reported on the attached well log was 71.25 feet below land surface, as measured in February 1992. Reportedly, this well was drilled after the area was quarried and, therefore, the water level depth is appropriate for today's conditions. This depth fits in the DRASTIC water level range of 50 to 75 feet, which has a rating of 3.

Net Recharge

Recharge is often difficult to quantify. In this case, however, an aquifer study was completed for the Shine area several miles northeast of the site. According to the report entitled *South Aquifer Study, Port Ludlow/Shine Area* (Robinson & Noble, 1992), the Shine area has a net recharge of 11 inches per year. The net recharge for the Ace Paving site can conservatively be estimated at more than 11 inches per year due to it being located to the southwest of the Shine area (and less in the rainshadow of the Olympics), and to the site having less evapotranspiration than the Shine area (since the site is largely devegetated). In a separate study of eastern Jefferson County, the general area of the site was thought to have a recharge rate of 15 to 20 inches (Economic and Engineering Services, Inc., and Pacific Groundwater Group, 1994). All recharge values above 10 inches yield a DRASTIC rating of 9.

Aquifer Media

The aquifer tapped by the Fred Hill Materials - Shine Pit well was described by the driller as sand. According to DRASTIC, sand and gravel have ratings of 4 to 9. Due to the lack of gravel within this aquifer, a conservative rating of 7 was chosen.

Soil Media

The site being evaluated is currently a gravel pit from which the soil has been removed during quarrying. However, portions of the 100-acre study area extend outside the quarry area and do have soils. Because these soils are very gravelly (due to the surface geology being recessional outwash gravel) and the majority of the study area is without soil, a DRASTIC rating of 10 was given for this factor.

Topography

Most of the site being evaluated has a gentle slope. However, the northeast portion of the study area dips downward to an elevation of approximately 200 feet, while the southwest corner has an elevation of 320 feet. This results in a maximum slope of 4 percent across the study area, although the average slope is certainly at 2 percent or less. A DRASTIC slope rating of 10, which is assigned to slopes of 0-2 percent, was used here.

Impact of Vadose Zone

According to the Fred Hill Shine Pit well log, the vadose zone materials are "hardpan" and sand. The hardpan is likely till and can be considered the same as the DRASTIC vadose zone material range called "sand and gravel with significant silt and clay", which is rated from 4 to 8. Sand is given a rating of 6 to 9. With the combination of the two units, a conservative rating of 7 was assigned.

Hydraulic Conductivity

The aquifer material is described as sand and fine sand. The specific capacity of the Fred Hill Materials Well at the time of construction was about 5.45 gpm/ft (gallons per minute per foot of drawdown) after pumping for one hour. According to a chart for estimating hydraulic conductivity from Heath (1983), the hydraulic conductivity for fine to medium sand materials is in the range of 10 to 700 gpd/ft^2. Using an equation for estimating transmissivity from Driscoll (1986) based on specific capacity, the aquifer has a transmissivity of 8175 gpd/ft, which computes to a hydraulic conductivity of 92 gpd/ft^2. Using the Theis equation and estimating a storage coefficient of 0.1, the estimated hydraulic conductivity based on test data form the well log is 586 gpd/ft^2. It can be concluded from these analyses that the conductivity is likely in the 300 to 700 gpd/ft^2 range, which has a rating of 4.

Drastic Index

The DRASTIC index for this unconfined aquifer is given below. The weighting for each DRASTIC factor is multiplied by the rating as determined above and the sum of the products forms the DRASTIC index.

Factor	Weight	Rating	Total
Depth to water	5	3	15
Net Recharge	4	9	36
Aquifer Media	3	7	21
Soil Media	2	10	20
Topography	1	10	10
Impact of Vadose Zone	5	7	35
Hydraulic Conductivity	3	4	12
	DRASTIC Index =		149

Summary

The DRASTIC index for this aquifer is 149. This rating reflects the low permeability of the exposed surface and vadose zone, the low slope, the moderate depth to water for the aquifer, and the relatively low to moderate hydraulic conductivity of the aquifer. This aquifer is apparently tapped by only one well in the near vicinity of the site. Other nearby wells, based on Department of Ecology logs, are approximately 4000 feet from the site and at a considerably lower elevation (located east of the site, near the Squamish Harbor). Based on the relatively low DRASTIC index and the lack of nearby wells, the drinking water supply for the area does not appear to be vulnerable to potential contamination by the proposed plant.

Respectfully Submitted,
Robinson & Noble, Inc.

Krista Sovie
Hydrogeologist

enclosures

cc: Ande Grahn, Madrona Planning
Richard Christopherson, Ace Paving

References Cited

Aller, L., Bennett, T., Lehr, J.H., Petty, R., and Hackett, G., 1987, *DRASTIC: A standardized System for evaluating ground water pollution potential using hydrogeologic settings*: U.S. Environmental Protection Agency Report EPA/600/2-87/035.

Economic and Engineering Services, Inc., and Pacific Groundwater Group, 1994, *Eastern Jefferson County groundwater characterization study*, Prepared for Public Utility District No. 1 of Jefferson County.

Grimstad, P., and Carson, R., 1981, *Geology and ground-water resources of eastern Jefferson County, Washington*, Water Supply Bulletin, No. 54, In Cooperation with Washington Department of Natural Resources Division of Geology and Earth Resources and Jefferson County Public Utility District No. 1.

Heath, R.C., 1983, *Basic ground-water hydrology*, U.S. Geological Survey Water-Supply Paper 2220.

Purdy, Joel W., and Becker, Joseph E., 1992, *South aquifer study Port Ludlow/Shine Area*, prepared by Robinson & Noble, Inc. for Ludlow Utilities.

EAST

Qal - Quaternary Alluvial deposits
Qvr - Quaternary Vashon recessional outwash
Qvt - Quaternary Vashon till
Qvt - Quaternary Vashon advance outwash
Qvl - Quaternary Vashon lacustrine deposits
Qw - Quaternary Whidbey Formation
Qdb - Quaternary Double Bluff Formation
Tv - Tertiary volcanics

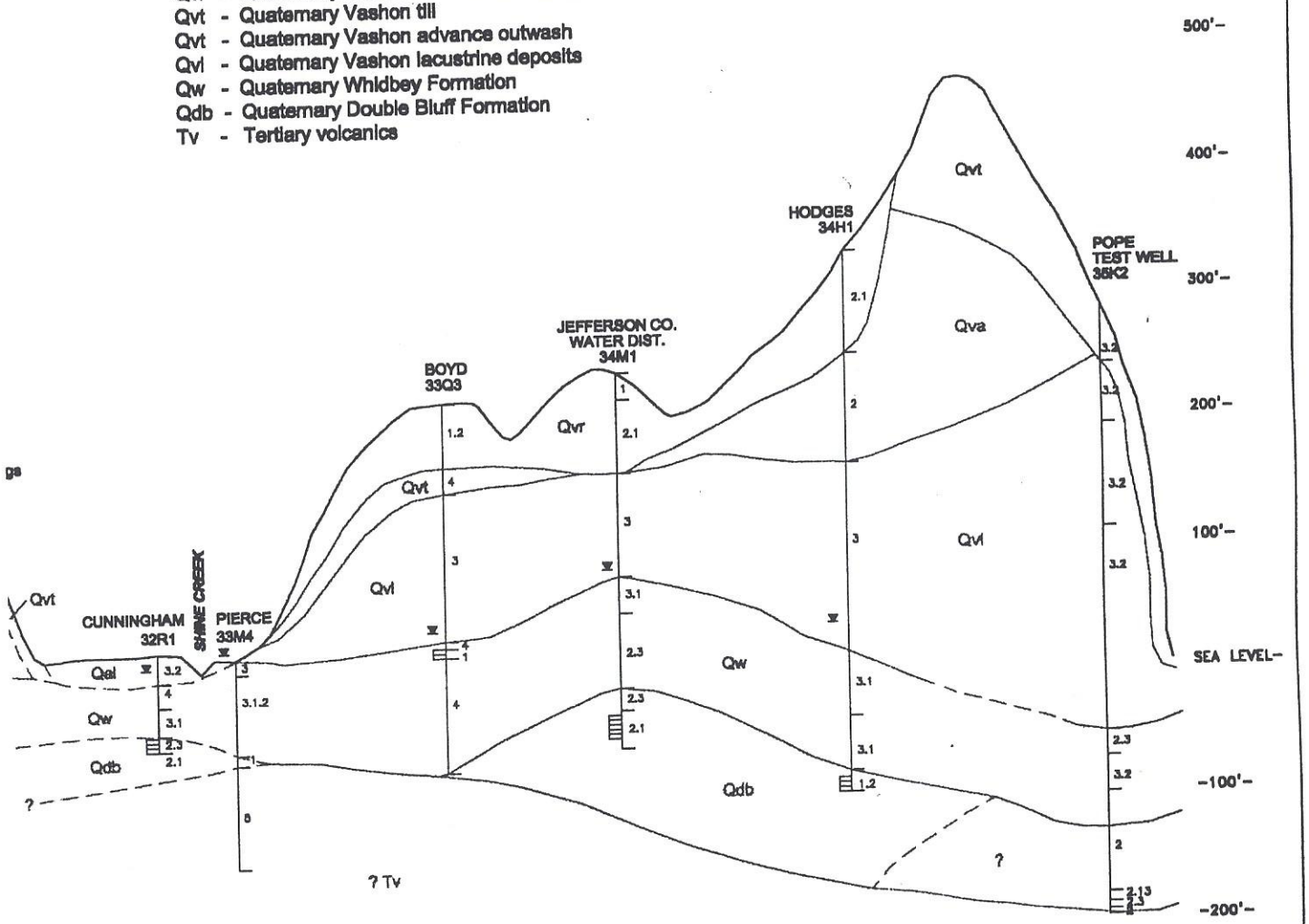
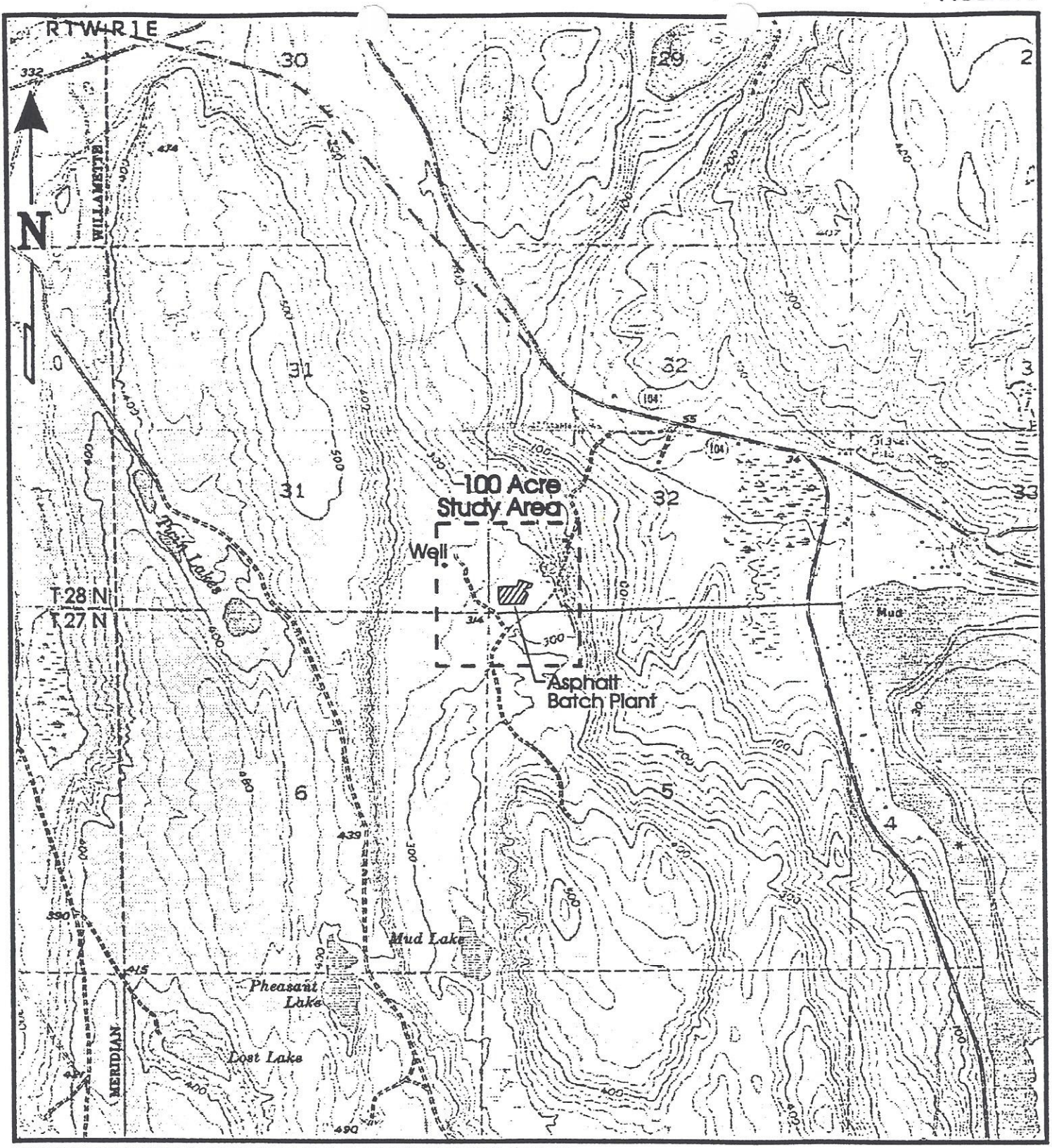


FIGURE 2
HYDROGEOLOGIC CROSS SECTION
FROM FIGURE 4, SOUTH AQUIFER STUDY, PORT LUDLOW/SHINE AREA (ROBINSON & NOBLE, INC., 1992)
ACE PAVING

ROBINSON & NOBLE, INC.

FIGURE 1



BASEMAP TAKEN FROM USGS LOFALL/PORT LUDLOW QUADS

ROBINSON & NOBLE, INC.

SCALE 1: 24,000

KITSAP COUNTY

SITE LOCATION MAP

Ace Paving

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Water Permit No. 28·1E·31R

(1) OWNER: Name Fred Hill Materials - Shine Rig Address State Rt. 104 - mile Post 10 Port

(2) LOCATION OF WELL: County Jefferson SE ¼ SE ¼ Sec 31 T 28 N., R 1E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address)

(3) PROPOSED USE: ☑ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned ☐ New well ☑ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled feet. Depth of completed well ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 160 ft.
Welded ☑ Liner installed ☐ Threaded ☐ " Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes ☐ No ☑
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☑ No ☐
Manufacturer's Name Johnson
Type Stainless Steel Model No.
Diam 6" Slot size #80 from 155 ft. to 160 ft.
Diam 6" Slot size #12 from 150 ft. to 155 ft.

Gravel packed: Yes ☐ No ☑ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☑ No ☐ To what depth? 22 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Flint & Walling
Type: Submersible H.P. 3

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 71' 3" ft. below top of well Date 2-92
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☑ No ☐ If yes, by whom? Driller
Yield: 60 gal./min. with 11 ft. drawdown after 1 hrs.
" " " "
" " " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated with at least one entry for each change of information.

MATERIAL	FROM	TO
Sand & Gravel	0	20
Sand	20	35
Hardpan	35	40
Sand	40	85
Fine Sand, little water	85	96
Brown Sandy clay	96	105
Sand, some water	105	161

RECEIVED
MAR 09 1992
DEPT. OF ECOLOGY

Work started Feb. 92 19. Completed Feb. 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Burt Well Drilling, Inc. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 19782 N.E. Lincoln Rd. Poulsbo

(Signed) George Burt (WELL DRILLER) License No. 0048

Contractor's Registration No. BURTWI★227BL Date 3-4 19

(USE ADDITIONAL SHEETS IF NECESSARY)

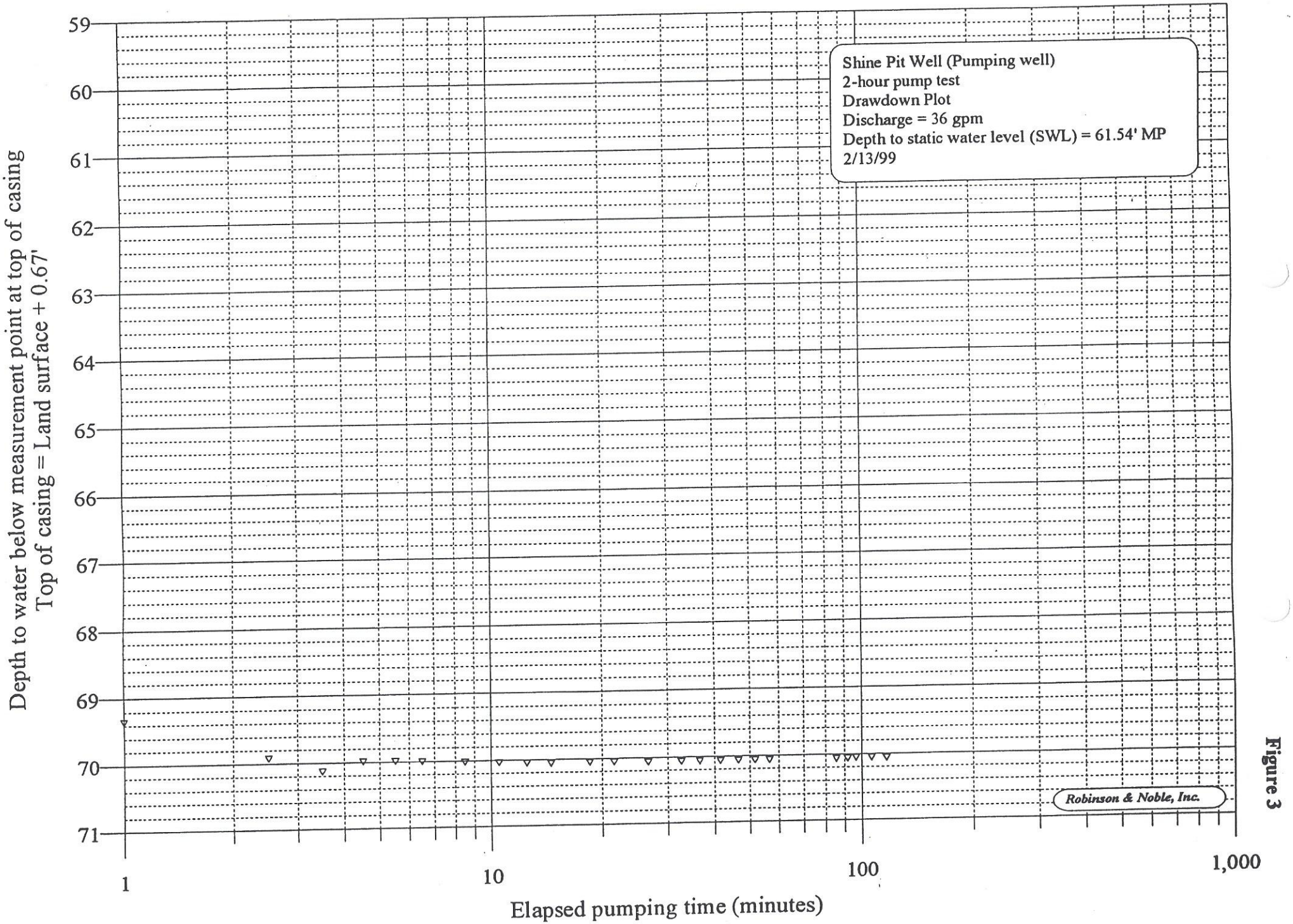

Shine Pit Well (Pumping well)
2-hour pump test
Drawdown Plot
Discharge = 36 gpm
Depth to static water level (SWL) = 61.54' MP
2/13/99
Robinson & Noble, Inc.
Depth to water below measurement point at top of casing
Top of casing = Land surface + 0.67'
59
60
61
62
63
64
65
66
67
68
69
70
71
1
10
100
1,000
Elapsed pumping time (minutes)

Figure 3

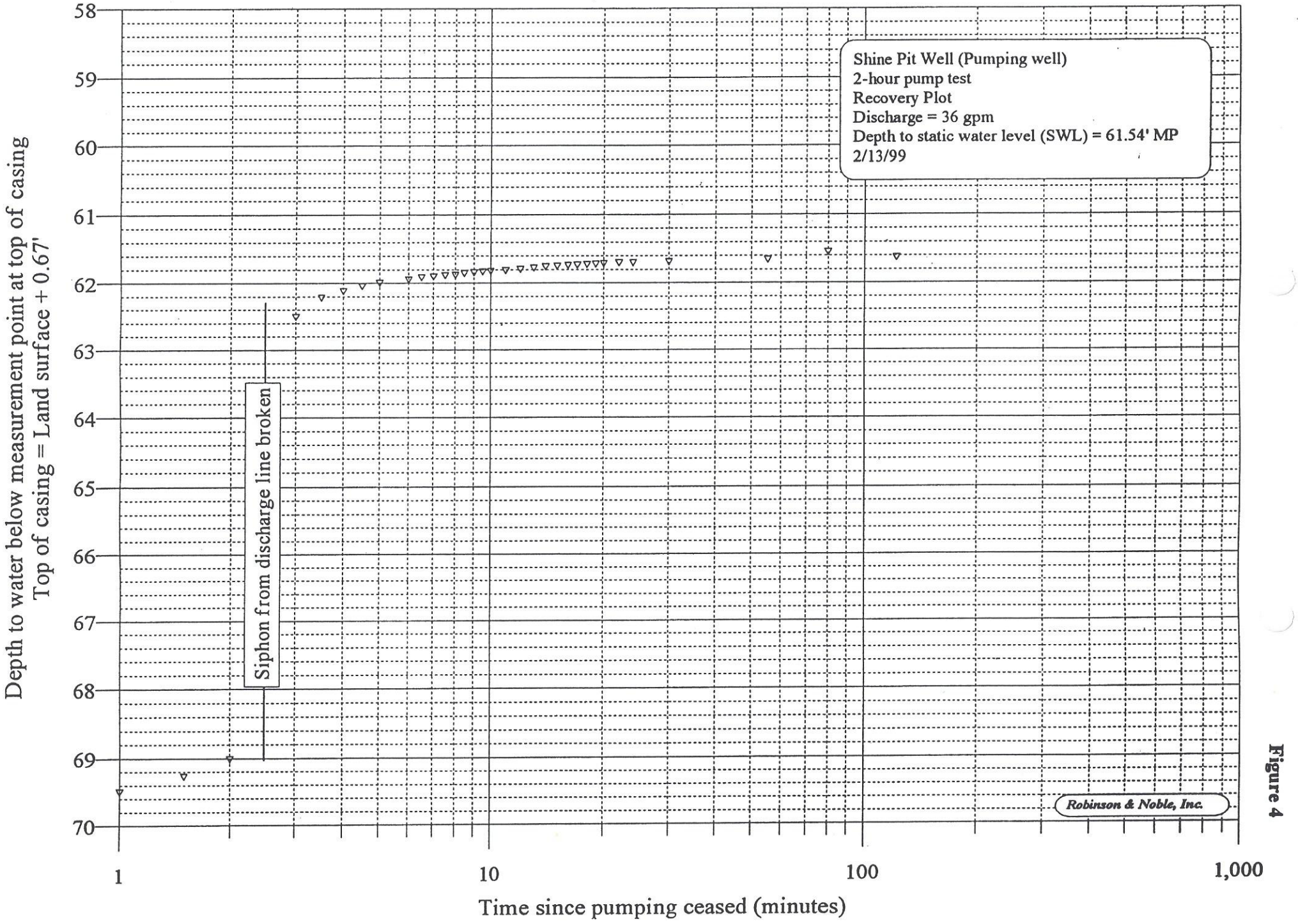

Shine Pit Well (Pumping well)
2-hour pump test
Recovery Plot
Discharge = 36 gpm
Depth to static water level (SWL) = 61.54' MP
2/13/99
Siphon from discharge line broken
Robinson & Noble, Inc.
Depth to water below measurement point at top of casing
Top of casing = Land surface + 0.67'
58
59
60
61
62
63
64
65
66
67
68
69
70
1
10
100
1,000
Time since pumping ceased (minutes)

Figure 4