

APPENDIX R

WELLHEAD PROTECTION PLAN



Wellhead Protection Plan

June 1998



EXPIRES 5/19/99

Approved by WDOH
December 9, 1997

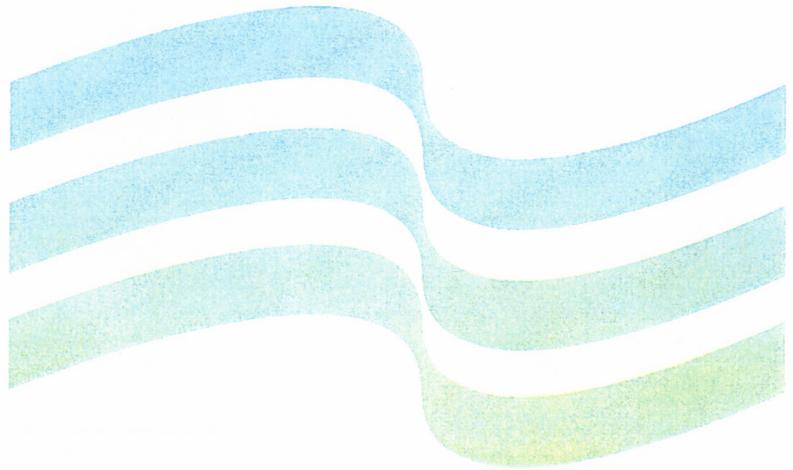


HDR Engineering, Inc.

WELLHEAD-PROTECTION-INFO.PDF



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CHAPTER 1

EXECUTIVE SUMMARY

Introduction

The City of Richland is developing a Wellhead Protection Program for their water system. The program focuses on the City's 18 wells which are located throughout the City. This Wellhead Protection Plan (WHP) provides an organized approach to protecting the drinking water sources for the City and a tool to support and initiate the City's Wellhead Protection Program.

Regulatory Framework

In 1986, the US Environmental Protection Agency (EPA) amended the federal Safe Drinking Water Act, requiring cities to develop wellhead protection programs (Section 1428). The intention of this regulation was to prevent the contamination of public water supplies relying on groundwater. At the time the Amendments were passed, it was well known that replacing a contaminated water supply was more expensive and more difficult than protecting an existing supply.

EPA developed the wellhead protection program in the late 1980s and early 1990s and included statutory requirements for all 50 states. The State of Washington developed their wellhead protection program during 1993 and 1994. The State's program was approved by EPA in 1994.

In July 1994, the State of Washington published new rules governing wellhead protection which were included in the general rules for Group A Public Water Systems (Chapter 246-290 WAC), and are administered by the Washington State Department of Health (WDOH). In 1995, WDOH published a *Wellhead Protection Program Guidance Document*. According to this document, WDOH requires wellhead protection programs to include:

- completed susceptibility analysis for each source;
- delineation of wellhead protection areas (WHPA) for each source;
- inventory of potential contaminant sources within each wellhead protection area, updated every two years;
- notification to owners/operators of potential contaminant sources that they are located within a WHPA;
- notification to regulatory agencies and local governments of the boundaries of the WHPAs and the results of the contaminant source;
- contingency plan to assure water supply customers have an adequate supply in the event that contamination causes temporary or permanent loss of water; and,
- coordination with emergency spill response teams regarding the location of WHPAs and water supply sources, and the results of contingency planning and the contaminant source inventory.

While the State WHP requirements initiate a wellhead protection program, it is the City's responsibility to determine appropriate management strategies to reduce the risk of groundwater contamination.

Scope of Work

The City of Richland and HDR developed a scope of work to initiate their WHP. The scope includes five main components that are summarized as follows:

Wellhead Delineation. The delineation of WHPAs requires technical analysis of the groundwater flow system. Hong West & Associates (HWA) provided expertise in hydrogeology and completed this phase of the project. HWA gathered existing data on the groundwater conditions of the area. WHPAs were delineated using two methods: the Calculated Fixed Radius and Analytical Methods;

Contaminant Source Inventory. During the preparation of the WHP, a contaminant source inventory was developed and partially verified. State and federal database listings and the City's business license database were searched by computer to identify addresses and types of contaminant sources occurring within the WHPAs. The lists generated from this search were provided to City staff who conducted a field survey to verify the search results. During the field survey, the City confirmed the potential sources and identified additional potential sources that were not disclosed by the search. Also, the City has since identified that governmental agencies are not listed on the business license database. Verification of these potential sources should be conducted during the two-year update. Once completed this data can be input into a database from which the City's geographical information system can access;

Groundwater Management Strategies. For this WHP, groundwater management refers to the actions implemented by the City to prevent the groundwater contamination. In developing the WHP, a list of management activities were identified and evaluated by the HDR, the City, and the WHPC. From this original list a subset of activities was selected and became the management recommendations for the WHP. The selection criteria included effectiveness, ability to implement, and costs;

Contingency Planning. The contingency plan is a "stand alone" document that identifies procedures to provide water in the event of water loss due to contamination, or natural or man-made disaster. Contingency planning involved a review of the existing pipeline, pumping, and source facilities in the City's water system. Contamination scenarios were then developed in which water supply from the primary groundwater source, North Richland Wellfield, were interrupted due to contamination. Procedures and recommendations were developed to assure the City could provide water supply during these emergency situations.

Public Involvement. At the beginning of the WHP, the City initiated a Wellhead Protection Committee (WHPC). The WHPC, composed of mostly City staff, reviewed, assisted, and offered recommendations during the WHP development.

Wellhead Protection Plan Organization

The WHP is organized into five sections documenting the work completed and analysis results. The chapters include:

- Chapter 2 presents the wellhead protection area delineations.
- Chapter 3 presents the results of the contaminant source inventory.
- Chapter 4 discusses and identifies groundwater management recommendations.
- Chapter 5 is the contingency plan which is a "stand alone" document.

CHAPTER 2

WELLHEAD PROTECTION AREA DELINEATION

Introduction

As part of the City of Richland's Wellhead Protection Plan, Hong West & Associates, Inc. (HWA) developed 1-, 5-, and 10-year time-of-travel (TOT) areas for 18 wells in the city's water supply system. Calculated fixed radius model areas were developed for all 18 wells. The TOT areas for 13 of the wells were further refined using an analytical computer model. This chapter documents the analysis and presents the results of the TOT delineations and includes the following sections:

- Source of Data
- Geology
- Groundwater Occurrence
- Well Characterization
- Calculated Fixed Radius Method
- Analytical Method
- Results and Discussion
- Bibliography

Source of Data

The City of Richland provided most of the information used during this analysis, including well locations and logs of all the wells (refer to Appendix A). Table 2-1 lists the studied wellfields with the City of Richland's wellfield names and the corresponding Washington State Department of Health (WDOH) well designations. Figure 2-1 shows the geographic location for the studied wellfields.

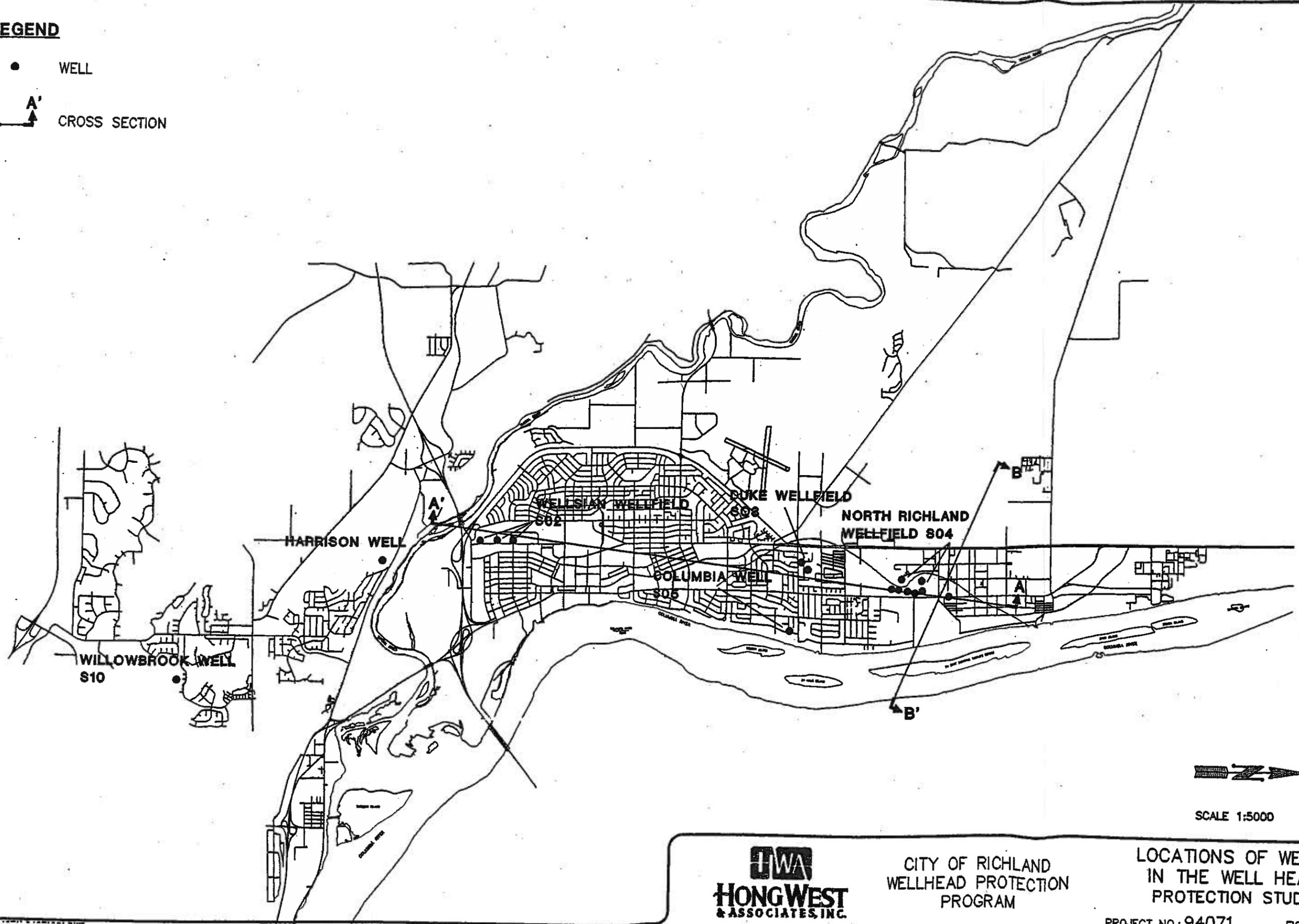
Table 2-1. City of Richland Wellfields

City of Richland Wellfield Names	WDOH Designations
Columbia River	S01
Wellsian Way Wellfield	S02
Duke Wellfield	S03
North Richland Wellfield	S04
Columbia Well	S05
Willowbrook Well	S10
Harrison Well	no WDOH designation

The City also provided past consultant reports, local geologic reports, past pumping and infiltration pond rates (refer to Table 2-2 for a summary of production parameters). During the course of the analysis, the city also provided a current set of water level data for the North Richland wellfield, with the system pumping for use in model verification.

LEGEND

- WELL
- A A' CROSS SECTION



SCALE 1:5000



CITY OF RICHLAND
WELLHEAD PROTECTION
PROGRAM

LOCATIONS OF WELLS
IN THE WELL HEAD
PROTECTION STUDY

PROJECT NO.: 94071

FIGURE: 2 - 1

TABLE 2-2. Well Summary and Fixed Radius Results

Wellfield	Well Number	X-Coord.	Y-Coord.	Ground Elevation (feet)	Depth (feet)	Screen Diameter (inches)	Top of Screen (depth-feet)	Bottom of Screen (depth-feet)	Static Water Depth (feet)	Static Water Elevation (feet)	Aquifer Thickness (feet)	Available Drawdown (feet)	Aquifer Tests					Rated Pump Capacity (gpm)	1 Year Fixed Radius (feet)	5 Year Fixed Radius (feet)	10 Year Fixed Radius (feet)		
													Data Source	Yield (gpm)	Drawdown (feet)	Time (hours)	Spec. Capacity (gpm/ft)					Transmissivity (gpd/ft)	Transmissivity (gpd/ft)
North Richland	3000-A	1949622.90	365986.20	395	88	20	47	82	37	358	48	41	Log '48	1000	3	12	333	517,000	1000	1704	3811	5389	
	3000-B	1950158.20	366026.00	390	89	20	45	82	30	360	52	49	Log '48	2000	5	12	400	829,000	1000	1658	3708	5242	
	3000-C	1950182.87	365203.26	370.3	65	20	30	60	11	359.3	54	44	Log '48	2000	14	12	143	206,000	1000	1841	4118	5821	
	3000-D	1949770.02	364999.22	385.3	75	20	40	70	23	362.3	>50	42	Log '48	2000	14.5	12	138	199,000	1000	1841	4118	5821	
	3000-D5	1950360.74	367473.03	407.5	134	12	55	125	49	358.5	78	75	Log '44	2000	6	18	333	517,000	1000	1205	2695	3811	
	3000-E	1950098.94	364729.77	367.8	61	17	21	57	11	356.8	48	40	Dec, '60	1125	4.55	1	247	435,000	2300	2548	5698	8058	
	3000-H	1950226.39	365583.98	380	56	20	26	50	30	350	>25	18	Log '48	1085	2.33	18	468	822,000	2000	2911	6508	9204	
	3000-J	1949646.19	365312.17	392	71	20	45	69	43	349	>28	18	ICF, '87	1340	4	1	133	200,000	2000	2911	6508	9204	
	3000-K	1950054.32	364344.85	365.4	57	20	15	50	15	350.4	38	32	Log '48	1800	18	24	100	150,000	1400	2435	5445	7701	
	3000-L	1949837.11	364725.17	392.1	83	20	55	80	50	342.1	>30	23	Log '48	2000	25	1.25	80	120,000	2000	2410	5389	7622	
														June '54	1000	7.8		158	199,000	1400	2388	5335	7545
	Duke	1100-D	1949058.47	359556.40	367.75	86	20	42	78	18	349.75	>30	58	Log '48	1260	38	9	33	43,500	2000	2376	5314	7515
1100-B		1948972.09	359578.13	369	120	10	44	120	19	350	75	91	Log '48	985	5		200-250	400,000	1000	1157	2588	3657	
Columbia	1100-B	1952437.19	358529.76	377	77	20	37	73	38	341	36	31	Log '48	1040	9.2		113	170,000	1000	1680	3757	5314	
													Log '48	1770	32.7		54	81,000					
Wellisian Way	4	1947525.03	341876.90	355	70	24	37	64	2	353	63	58	Log '43		33.3			1500	2376	5314	7515		
	5	1947567.81	340902.89	360	72	18	46	68	7	353	63	55	Log '43	1560				1500	2633	5887	8328		
	14	1947517.12	342774.18	354.83	56	10	33	56	12	342.83	40	34	Log '91	700	0	2	700	1,050,000	1000	2102	4701	6648	
Harrison	(Heritage)	1948758.04	335546.26	615.5	360	12	340	360	132	483.5		218	Log '78	500				700	1886	4218	5865		
Tapteal	Tapteal	NOT YET INSTALLED																					
Willowbrook	Willowbrook	1955524.00	324229.45	489.14	1208	14	1014	1208	88	401.14	200	1110	Log '80	600	104	2	6	7,700	1000	724	1619	2289	
														800	174	4	5	6,000					
														1000	277	6	4	4,600					
														1200	362	8	3	4,200					

1 Mainly from original drill data or old test data.
 2 Aquifer Thickness estimated from drill logs of wells.
 3 Available drawdown defined as static water level minus 10 feet above bottom of hole.
 4 Specific Capacity = Q/s, when drawdown(s)=0 a value of 1 is used.
 5 Transmissivity calculated by $T=264Q/s \log(0.37r^2/S)$.
 6 Transmissivity calculated by $T=Q^2/1500s$ for unconfined aquifer and $T=Q^2/2000s$ for confined aquifer.
 where: Q=yield(gpm), s=drawdown(ft), T=transmissivity(gpd/ft), t=time(days), r=radius(ft), S=storativity(.075 unconfined, .005 confined)
 Bold/italic - estimated

Geology

The geology of the North Richland area consists of three main units; the Hanford Formation (informal name), the Ringold Formation and the Columbia River Basalt Group. Figure 2-2 shows a cross section of the area from the Yakima river through the North Richland Wellfield

The Hanford Formation, uppermost of the three formations, consists of approximately 25 feet of young, sandy, gravels with particle sizes ranging from silt to boulders. The Hanford Formation was deposited during outburst flood events from the failure of ice-dammed marginal lakes along the Columbia (Reidel and Fecht, 1994).

Below the Hanford Formation lies the Ringold Formation (ICF Northwest, 1987). The Ringold is a Tertiary alluvial deposit approximately 100-150 ft. thick in the North Richland area. Locally, it includes of sandy silts and clays with local interbeds of sand (Reidel and Fecht, 1994). Regionally, the Ringold Formation has been divided into three units within the Pasco Basin (Rockwell International, 1979). These units consist of; fine sands and silts in the upper layer; sands and gravels within the middle layer; and, silts and clays with isolated gravel lens in the lower layer.

The Columbia River Basalt Group underlies the alluvial deposits of the Ringold Formation. This Group, the extent of which defines the Columbia Plateau, represents a massive out-pouring of flood basalt that occurred between 17.5 - 6 million years ago (Reidel et al. 1994). The Basalt Group includes three major units, from top to bottom; the Saddle Mountains, Wanapum and the Grande Ronde (Rockwell International, 1979). Within each of these three major basalt units occurs numerous interflow zones and sedimentary interbeds (Rockwell International, 1979).

Groundwater Occurrence

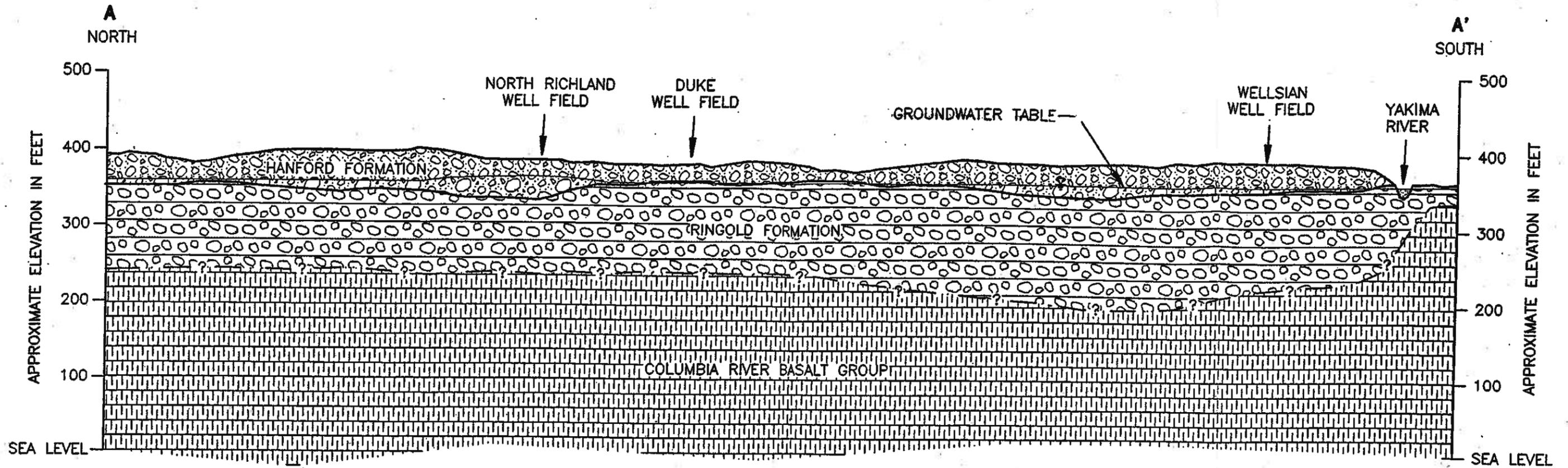
For the purpose of these analysis we have divided groundwater occurrence within the Pasco Basin into two significant systems; a shallow unconfined water table aquifer system and a deeper confined aquifer system within the basalt. The two aquifers are separated by an aquiclude consisting of the silts and clays which define the lower portion of the Ringold Formation (Rockwell International, 1979). Figure 2-3 shows a generalized hydrogeologic model of the North Richland Wellfield. Figure 2-4 shows a potentometric map of the same area.

Shallow Aquifer

In the Richland area, the water table aquifer occurs within the alluvial deposits of the Hanford and Ringold Formations. Groundwater comprising the water table aquifer in the North Richland area flows generally eastward from the Yakima River to the Columbia River (ICF Northwest, 1987). The Yakima River is the source of recharge for the groundwater beneath the Richland area with the Columbia River serving as the discharge point. The top of the water table aquifer lies near the contact between the Hanford Formation and the Ringold Formation.

Basalt Aquifers

Groundwater occurs within all three of the Columbia River Basalt Group units. Hydraulic conductivity values differ within the levels of strata of each unit. The dense basalt has the lowest hydraulic conductivity values, with the interflow and sedimentary interbeds having higher values.



LEGEND

-  HANFORD FORMATION
-  RINGOLD FORMATION
-  COLUMBIA RIVER BASALT GROUP
-  - ? - INFERRED GEOLOGIC CONTACT

NOTES

1. MODIFIED AFTER CORNELL ET AL., 1972.
2. REFER TO FIGURE 1 FOR LOCATION OF CROSS SECTION A-A'.



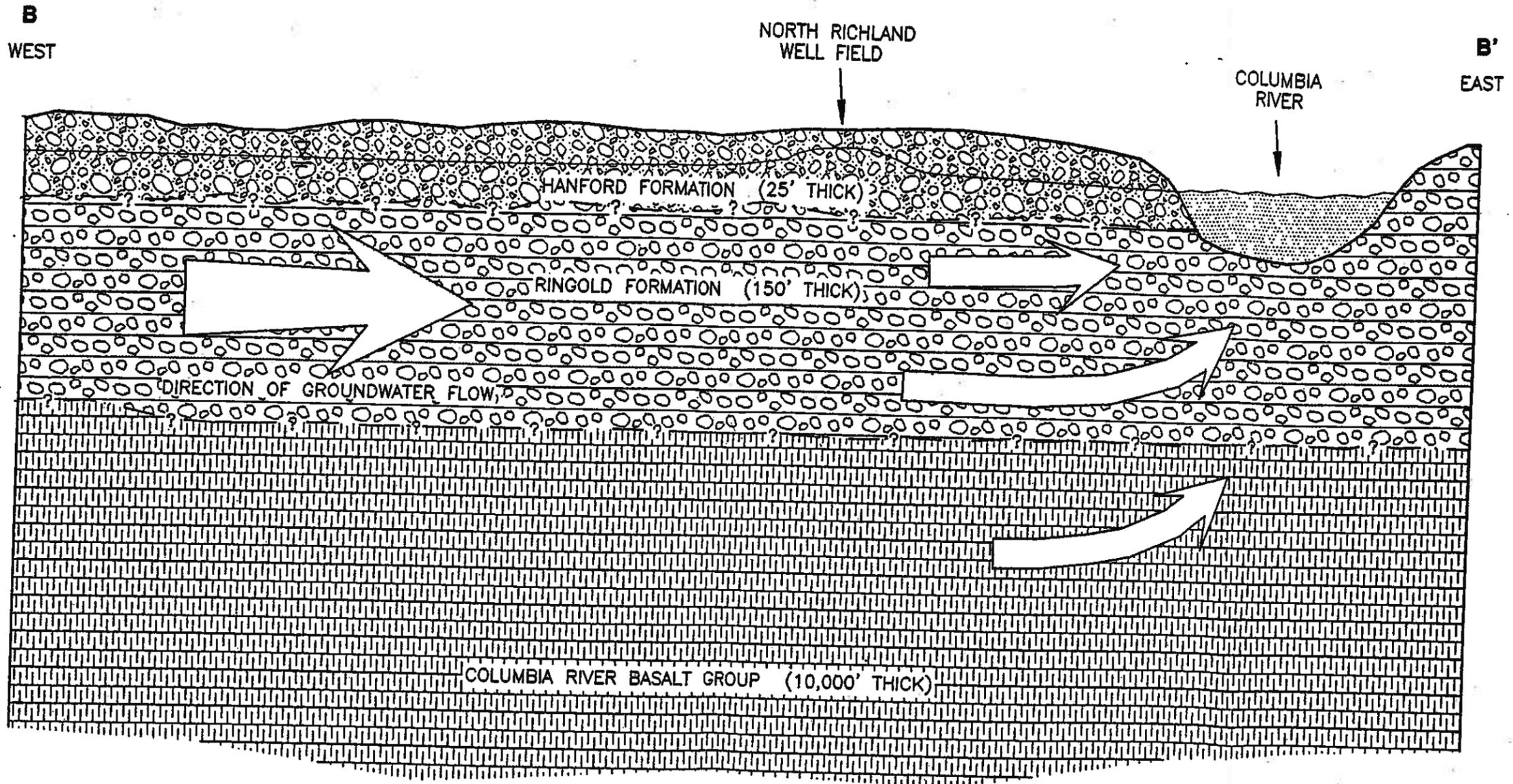
DWA
HONGWEST
 & ASSOCIATES, INC.

CITY OF RICHLAND
 WELLHEAD PROTECTION
 PROGRAM

GENERALIZED NORTH/SOUTH
 GEOLOGIC CROSS SECTION

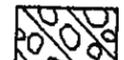
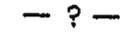
PROJECT NO.: 94071

FIGURE: 2 - 2



NOT TO SCALE

LEGEND

-  HANFORD FORMATION
-  RINGOLD FORMATION
-  COLUMBIA RIVER BASALT GROUP
-  — ? — INFERRED GEOLOGIC CONTACT

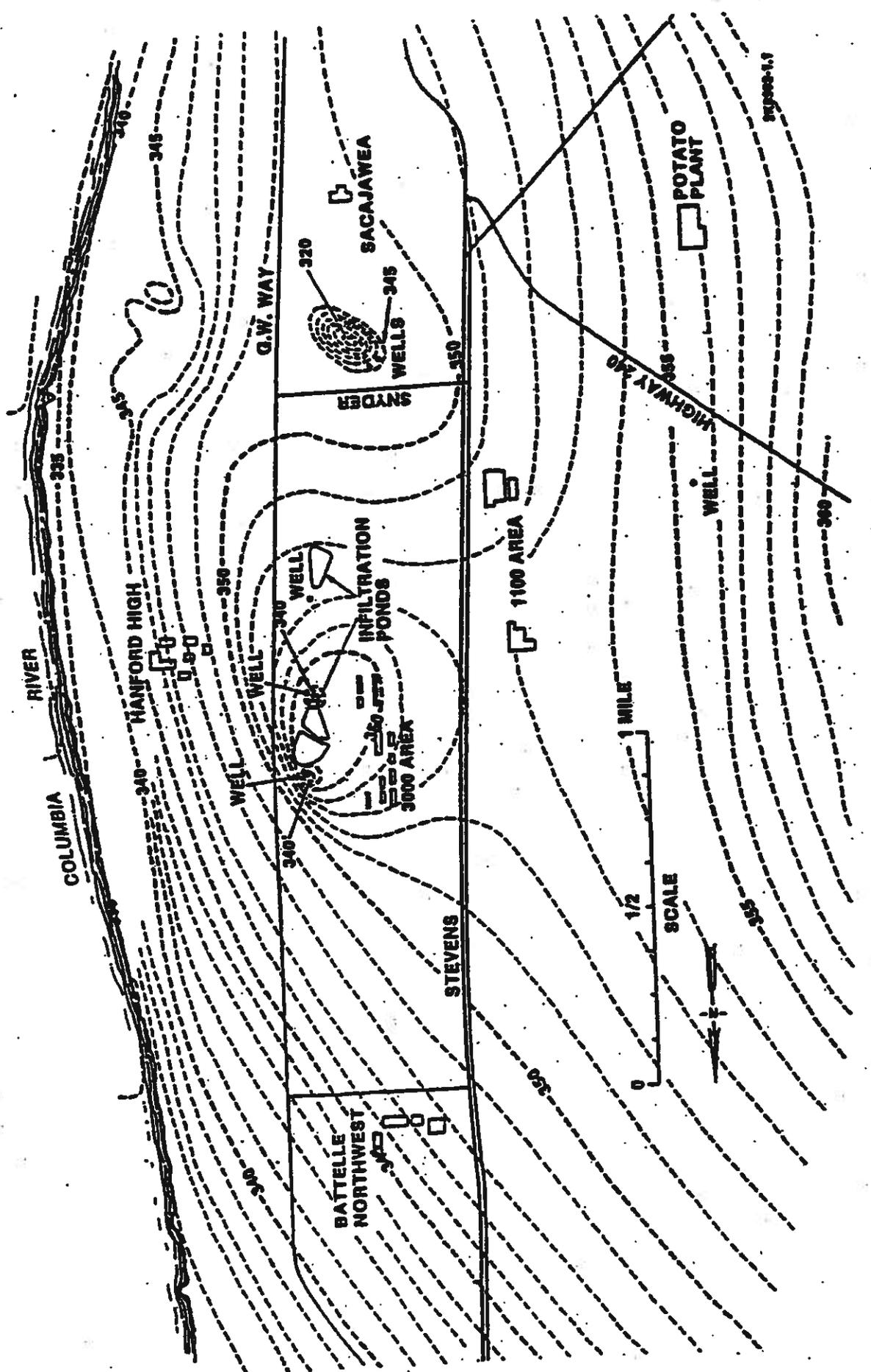
NOTES

1. REFER TO FIGURE 1 FOR LOCATION OF CROSS SECTION B-B'.



CITY OF RICHLAND
WELLHEAD PROTECTION
PROGRAM

GENERALIZED EAST/WEST
HYDROGEOLOGIC MODEL
NORTH WELLFIELD



POTENTIOMETRIC MAP OF
NORTH RICHLAND
(FROM ICF NORTHWEST, 1987)

CITY OF RICHLAND
WELLHEAD PROTECTION
PROGRAM



Below the Richland area, groundwater of the confined aquifers generally flows north-east with Saddle Mountains and Wanapum units. The basalt aquifers beneath the Richland area are recharged by subsurface flow from distant (10+ miles) surface recharge areas northeast and south-southeast of the Richland area. The basalt aquifers discharge to the Yakima and Columbia Rivers in the vicinity of Richland (Gephart and others, 1979).

Well Characterization

Sixteen of the City of Richland's eighteen wells are located in unconsolidated deposits of the shallow water table aquifer, less than 150 feet deep. The remaining two are deeper wells completed within basalt aquifer zones. Insufficient data exist to establish the specific basalt unit the City's wells produce from. Of the 16 shallow wells, 10 are within the North Richland Wellfield, which also contains recharge basins receiving surface water pumped up from the Columbia River. Past pumping data indicate that the amount of recharge to the ponds is roughly double the amount of water pumped out. The recharge creates a groundwater mound in order to inhibit drawing groundwater in from the Hanford areas to the north and west of the wellfield. Table 2-2 summarizes the information for the wells.

Calculated Fixed Radius Method

Table 2-2 summarizes the 1, 5, and 10 year calculated fixed radii (CFR) for all wells in the City of Richland's water supply system. The radii were calculated based on the highest pump rating available for each well (at least three pump ratings were found for each well), by the method outlined in the Washington State Wellhead Protection Program (WDOH, 1993). Radii were calculated using the following formula:

$$r = \sqrt{\frac{Q t}{\pi n H}}$$

where:

r = calculated fixed radius

Q = pumping rate of well

n = aquifer porosity

H = open interval or length of well screen

t = travel time to well (1, 5, or 10 years)

$\pi = 3.1415$

Aquifer porosity is the ratio of the volume of void space within a unit volume of earth over the unit volume of earth. For the CFR calculations we used a generalized value of 0.22 as supplied by the WDOH (WDOH, 1993). WDOH suggests this value for use in calculations where little or no data is available on the porosity of the aquifer.

Analytical Method

Analytical methods include simple mathematical calculations and graphical methods or simple analytical solution based computerized groundwater flow models. Analytical methods can provide more reliable predictions of groundwater flow than a calculated fixed radius method because they incorporate a greater number of site specific parameters. Several groundwater computer programs utilize two-dimensional analytic solutions to model groundwater flow. HWA used the TWODAN computer analytical groundwater flow model (Fitts, 1994) to further refine, from the fixed-radius calculations, the time-of-travel boundaries for the North Richland, Duke, and Columbia Wellfields. Figure 2-5 shows the results of both CFR and computer-model calculated time-of-travel boundaries.

The TWODAN Model

The TWODAN computer modeling program uses analytic solutions to simulate two-dimensional groundwater flow. The program is capable of superpositioning large numbers of analytic solutions to model diverse and irregular boundary conditions. The analytic solutions and "Analytic Element Method" approach described by Strack (1989) form the basis for the TWODAN program. We elected to use the TWODAN model for the Richland Wellfield analysis because it readily accommodates the infiltration ponds of the North Wellfield.

Model Setup. The TWODAN model was setup using available information on wells, recharge areas, and aquifer properties. The model consists of input for aquifer definition and uniform flow field, 13 wells, 5 recharge areas simulating the recharge basins, and 5 linesinks (fixed water level lines) representing the Columbia River.

The TWODAN model was run under the following criteria:

Aquifer Input Data: The model was setup to encompass both the Ringold and Hanford Formations within the North Richland, Duke and Columbia Wellfield areas. Because of the lack of available data, both aquifers were modeled together as a homogenous unit of fixed hydraulic conductivity. Hydraulic conductivity was set at 295 ft/day and derived from average aquifer thickness and average aquifer transmissivity.

Uniform Crossflow Data: The uniform aquifer discharge rate is the product of the aquifer transmissivity and the hydraulic gradient. The transmissivity value for the model, 44,114 ft³/day/ft, was calculated by averaging the transmissivity values for the North Richland, Duke and Columbia Wellfields.

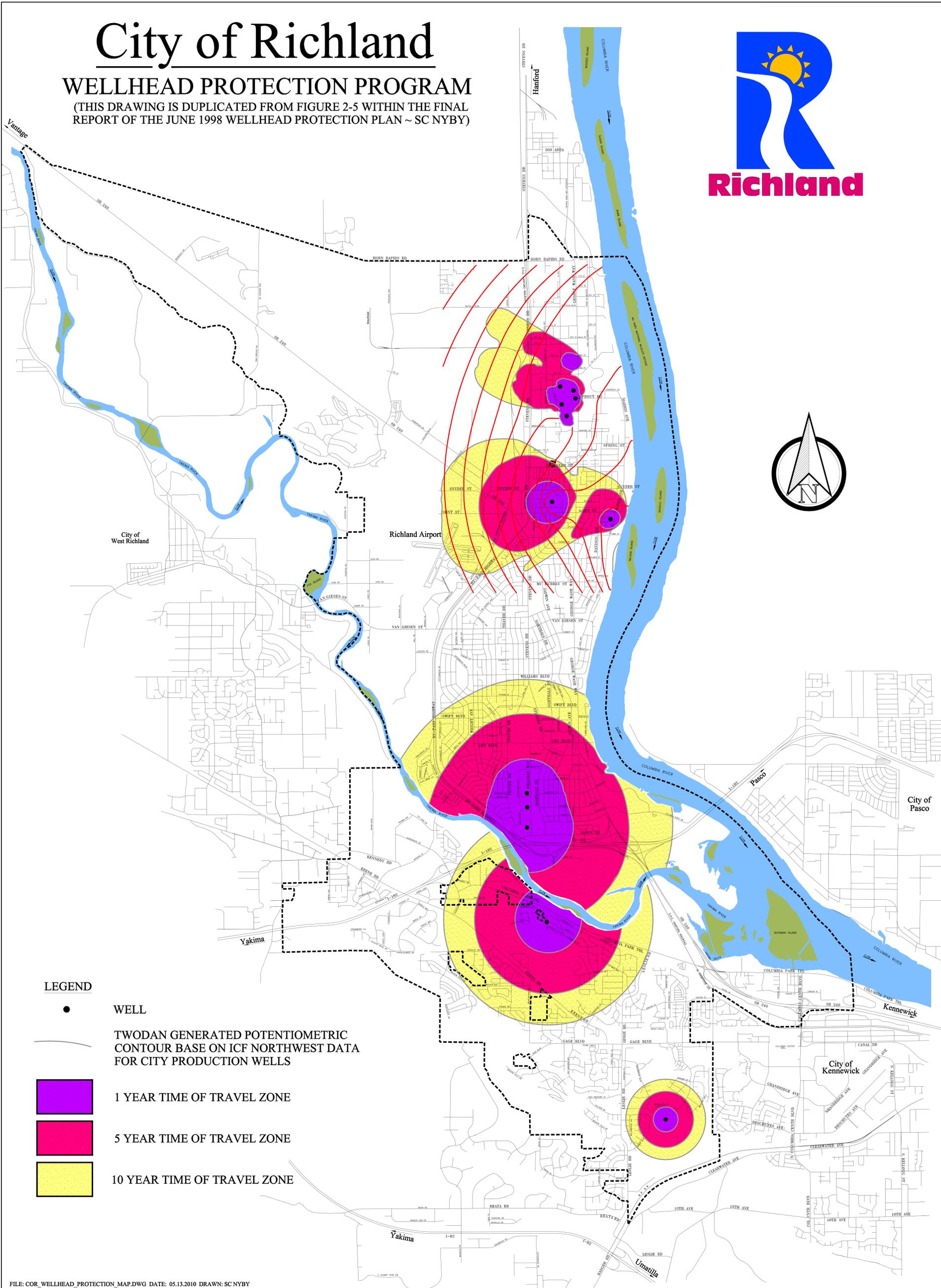
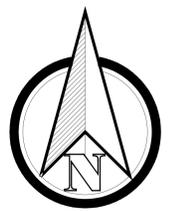
Circular Areas of Local Recharge: Five circles were used to simulate the shape and area of the three infiltration ponds at the center of the North Richland Wellfield. The modeled incremental infiltration rate was equivalent for the five circles. A value of 3.8 ft³/day/ft² was used to provide a daily recharge of a little over 12 million gallons per day (gpd)

Discharge-specified wells: City of Richland wells model number 1 through 10 represent the North Richland Wellfield, wells 11 and 12 the Duke Wellfield, and well 13 the Columbia Wellfield (refer to Appendix A for well logs and well designations). The modeled discharge values for the wells were set at a little over half the daily recharge values for the infiltration ponds. From the available data, this scenario appears to be an accurate representation of the actual recharge/discharge system.

City of Richland

WELLHEAD PROTECTION PROGRAM

(THIS DRAWING IS DUPLICATED FROM FIGURE 2-5 WITHIN THE FINAL REPORT OF THE JUNE 1998 WELLHEAD PROTECTION PLAN ~ SC NYBY)



Head-Specified Linesinks: Linesinks, representing lines of equal head, were used to model the Columbia River. Five linesinks were used to approximate the gradient and the west bank of the river.

Refer to Appendix B for additional details of the model setup. AutoCAD produced .dxf files of the analytical model TOT areas have been provided to the City of Richland for incorporation into the City's GIS system.

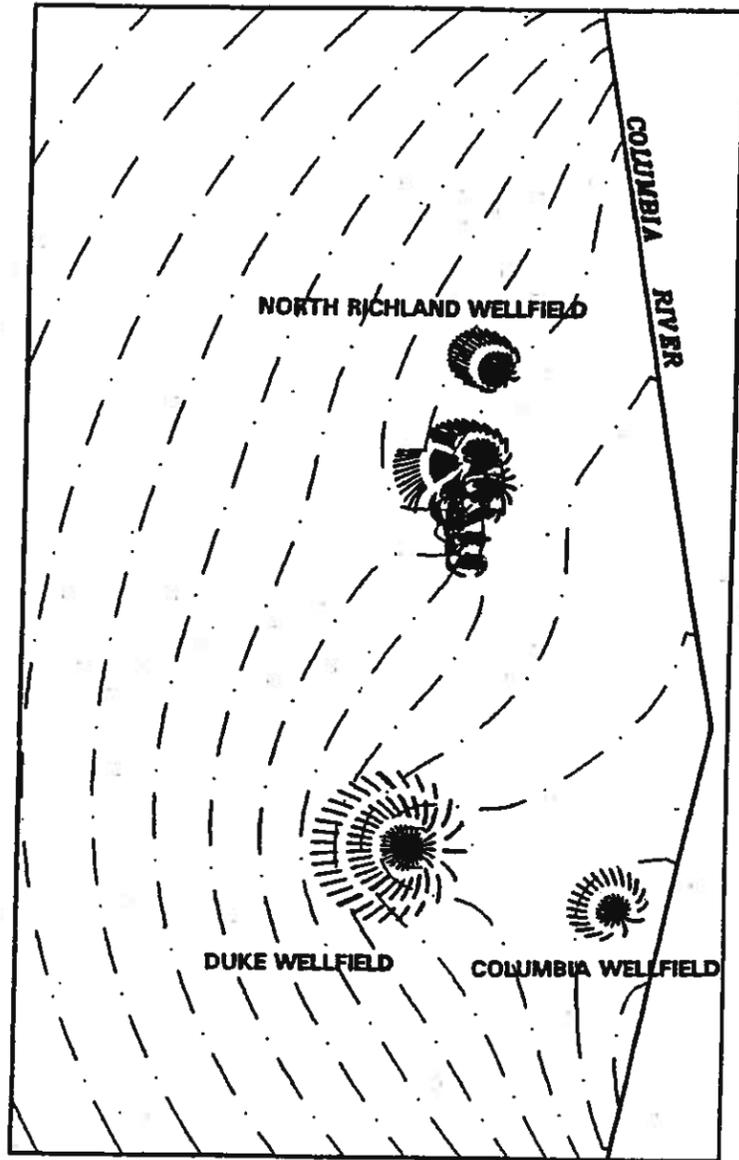
Model Calibration and Verification. Insufficient data exist to perform a complete model calibration. Data exists for water levels for specific times, but the pumping data is lacking in sufficient detail for full model calibration. We verified the model by comparing a no pumping scenario with static water levels for surrounding wells and groundwater elevation data from Liikala (1994). We then compared different pumping scenarios for actual data we had available. In all cases the output from the computer model was a reasonable match of the actual data (refer to reference point boundary conditions and head-specified linesink boundary conditions, Appendix B).

Results and Discussion

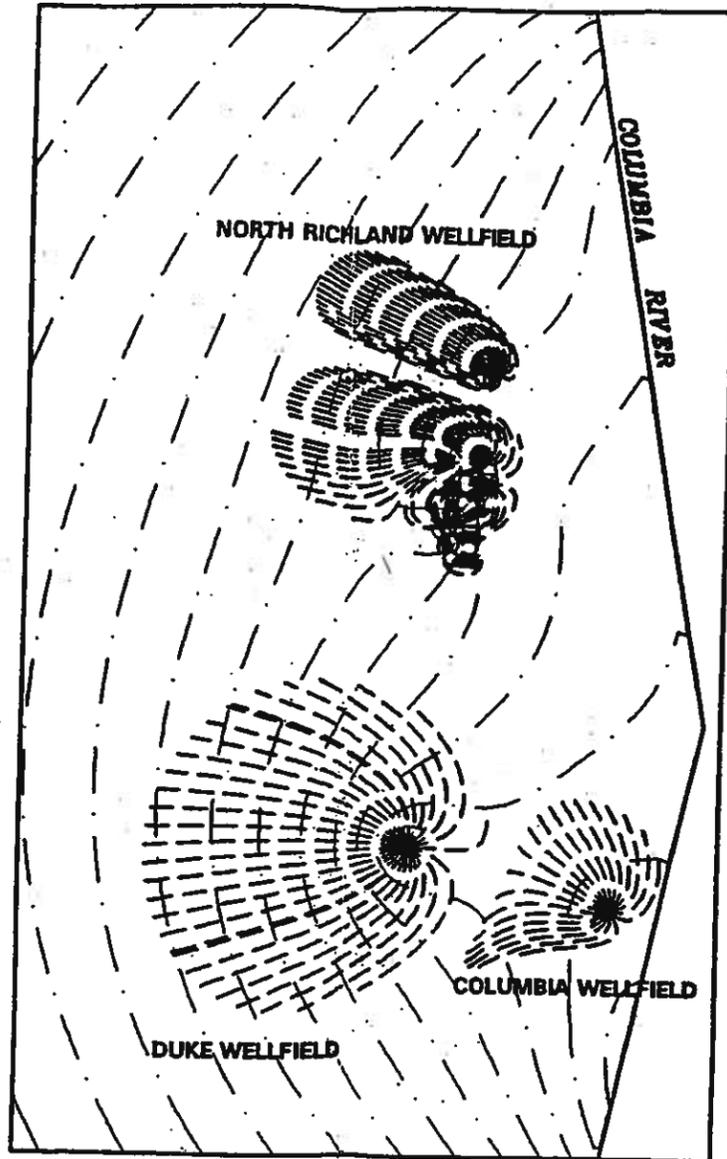
The results of the model are definitions of three time-of-travel boundaries, 1-year, 5-year and 10-year. The time-of-travel boundaries illustrated on Figure 2-6, show the flow paths radiating from each of the wells in the North Richland Wellfield, the Duke and Columbia Wellfields. Figure 2-6 illustrates that the majority of the flowpaths, and hence the source of most of the water, for the northern most wells in the North Richland Wellfield, is to west of the wellfield, not the recharge basins. This is likely due to the location of the wells relative to the recharge basins. The Duke and Columbia wells appear to be affected only slightly, if at all, from the recharge basins.

As Figure 2-5 illustrates, we have modified the CFR's for the five wells not redefined by the analytical method do not take into account any surface features or known boundary conditions. For example, the radii for the Wellsian Way wells, in some cases, intersect the Yakima River, to the south of the wells. The Yakima River, and Columbia River to the east, serve as a boundaries for the shallow unconfined aquifer system in the Richland area.

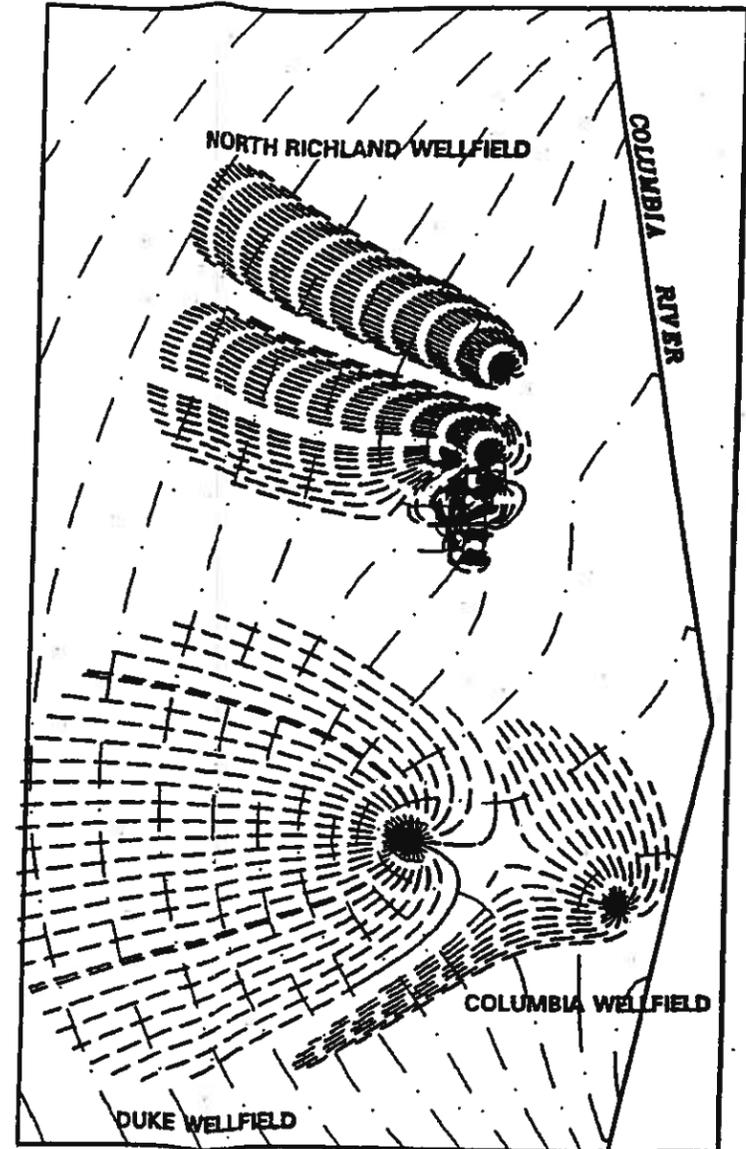
The CFR's for the two wells in basalt aquifers are also not likely reflective of reality. As discussed in the preceding section on groundwater occurrence, the recharge area for the basalt aquifers likely occurs some distance from the City's basalt wells and their CFR zones. Along portions of their reach in the Richland area, the Yakima and Columbia Rivers likely serve as discharge zones for the basalt aquifers. However, a zone of protection around the wellhead, defined as a sanitary control area, is required by WAC 246-290-135. The control area will help reduce contamination from potential sources at the surface near the wellheads (i.e. spills, leaks, etc.).



1 YEAR



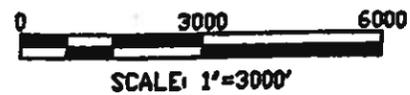
5 YEAR



10 YEAR

LEGEND

- GROUNDWATER CONTOURS
- - - GROUNDWATER FLOWPATHS



JWA
HONGWEST
 & ASSOCIATES, INC.

CITY OF RICHLAND
 WELLHEAD PROTECTION
 PROGRAM

1, 5, AND 10 YEAR
 TIME OF TRAVEL
 COMPUTER MODEL RESULTS

PROJECT NO.: 94071

FIGURE: 2 - 6

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CHAPTER 3

CONTAMINANT SOURCE INVENTORY

Introduction

The identification of known and potential sources of contaminant sources is one of the components of a Wellhead Protection Plan (WHPP). The wellhead protection areas (WHPAs), identified in an earlier phase of the plan, focus the inventory effort upon the WHPAs and the contaminants that could disrupt the community's drinking water sources.

Washington State Department of Health (WDOH) requires the development of a contaminant source inventory for Group A water systems. These regulations are summarized as follows:

"Washington Administrative Code (WAC) 256-290-135 (4)(c) - The purveyor's wellhead protection plan shall contain, at a minimum, the following elements:

(iii) A list of all actual and potential groundwater contaminant sources located within the defined WHPAs. This list shall be updated every two years; and

(iv) Documentation of purveyor's notification to all owners/operators of actual and potential sources of groundwater contamination within the WHPAs boundaries."

The work presented in this chapter fulfills the WDOH requirement for developing a contaminant source inventory. A database was created and integrated with the City's AutoCAD mapping. The business license database will also be integrated into the City's Geographic Information System (GIS) and will be used for maintaining and updating the contaminant source inventory. The City of Richland will issue notice to those property owners/operators of the potential contaminant sources and to the local, state, or federal agency that regulates each business. Documentation of these notices will be kept by the City.

Land Use

Land use is important in evaluating the vulnerability of groundwater resources and in developing groundwater management strategies. Table 3-1 lists general categories of land uses and ranks them in order of their risk to groundwater — A1 to E4. Commercial and industrial land use zones are historically known to be the cause of many point source groundwater contamination incidents. Management of the activities occurring in these land use areas (and other land uses areas) can effectively prevent groundwater contamination. Figure 3-1 and Table 3-2 illustrate a summary of the land uses that occur in the City of Richland's WHPAs. Table 3-2 provides a general listing of the typical uses permitted within each of Richland's zoning classification.

Past land use evaluation using old aerial photographs will be conducted during the inventory update to ascertain as whether any contamination may have been built over or excavated. Review of these photographs for large facilities or ground stains will also help to determine past potential discharges of hazardous materials.

Table 3-1. Land Uses and Their Relative Risks to Groundwater

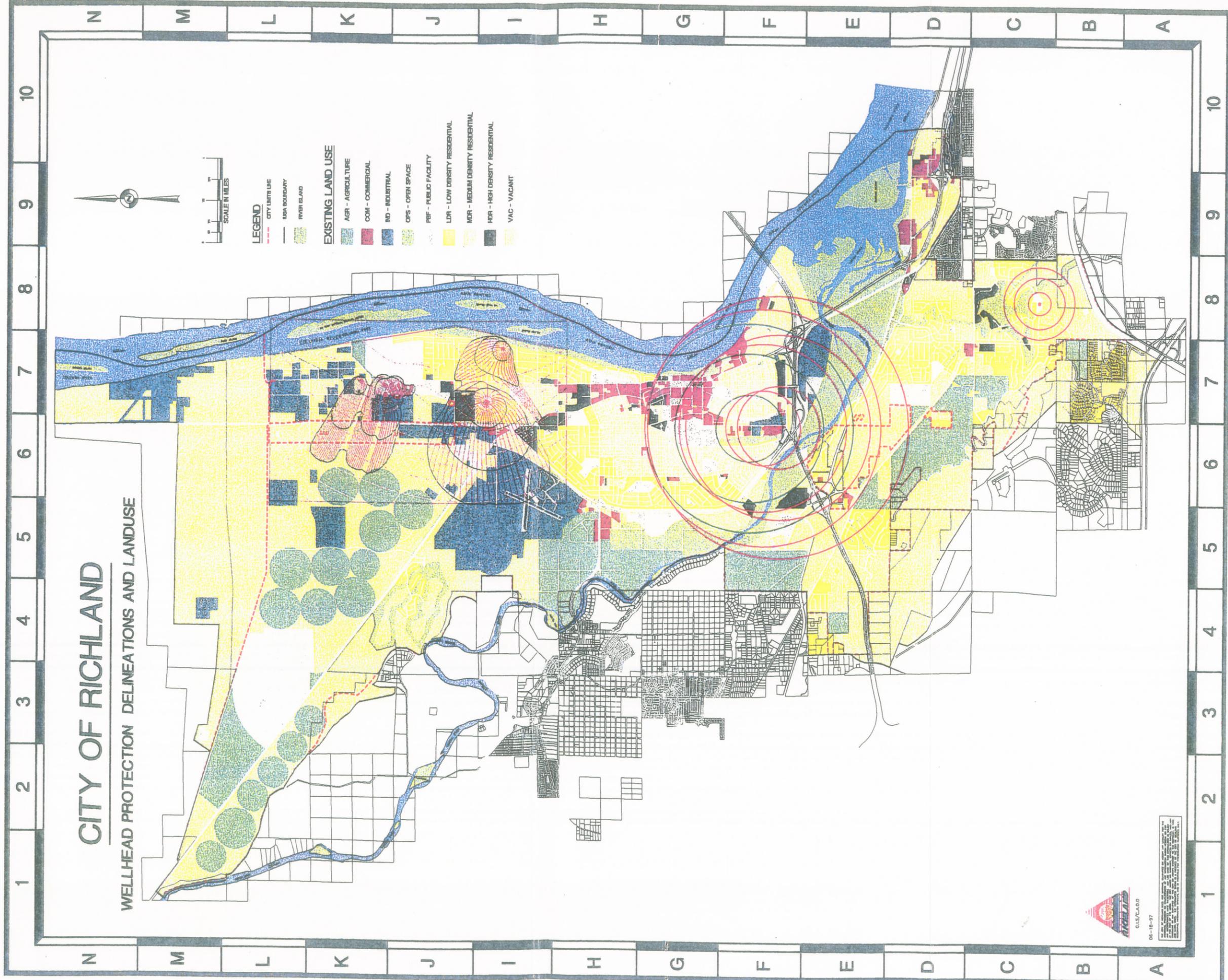
Least Risk	A1	Land surrounding a well or reservoir, owned by the City
	A2	Permanent open space dedicated to passive recreation
	A3	Federal, state, municipal, and private parks
	A4	Woodlands managed for forest products
	A5	Permanent open space dedicated to active recreation
	B1	Field crops: pasture, hay, grains, and vegetables
	B2	Low density residential: lots larger than 2 acres
	B3	Churches, municipal offices
	C1	Agricultural production: dairy, livestock, poultry, nurseries, orchards, and berries
	C2	Golf courses, quarries
	C3	Medium density residential: lots from 1/2 to 1 acre
	D1	Institutional uses: schools, hospitals, nursing homes, prisons, garages, salt storage, sewage treatment facilities
	D2	High density residential: lots less than 1/2 acre
	D3	Commercial uses: limited hazardous material storage and only sewage disposal
	E1	Retail commercial: gasoline, farm equipment, automotive; sales and services; dry cleaners; photo processing; medical arts; furniture strippers; machine shops; radiator repair; printers; fuel oil distributors
	E2	Industrial: all forms of manufacturing and processing
	E3	Underground storage of chemical, petroleum
Greatest Risk	E4	Waste disposal: pits, ponds, lagoons, injection wells used for waste disposal; bulky waste and domestic garbage landfills; hazardous waste treatment, storage, and disposal sites

Table 3-2. Zoning Classification and Permitted Uses

Description	Symbol	Typical Uses
Floodplain	FP	Pasture, recreation, agriculture.
Agricultural	AG	Agriculture, horticulture, recreational vehicle campground, 5 acre minimum subdivision.
Suburban Agricultural	SAG	Residential uses 43,560 sf (1 acre) minimum lot size. Limited agriculture.
Suburban Residential	R-1	Single family residence: 13,000 sf minimum lot size; 15,000 sf average lot size for subdivision.
Single Family Residential (Low)	R-1L	Single family residence: 10,000 sf minimum lot size; 12,000 sf average lot size for subdivision.
Single Family Residential (High)	R-1M	Single family residence: 8,000 sf minimum lot size; 10,000 sf average lot size for subdivision.
High Density Residential	R-2	Residential uses: 6,000 sf minimum lot size for single family residence; 10,000 sf minimum lot size for duplex.
Multiple Family Residential	R-3	Single family, duplex, multi-family residential: single family 6,000 sf; duplex 10,000 sf; 3,000 sf per dwelling unit.
Limited Business	C-LB	Offices, clubs, motels, clinics, apartments.
Neighborhood Retail	C-1	Convenience stores serving immediate neighborhood.
Central Business	C-2	Retail activities, motel, restaurants, etc.
General Business	C-3	Retail-wholesale: small fabrication; used-new car sales
Commercial-Recreation	C-R	Marina resort, hotel, motel, commercial recreation, recreational vehicle campground, recreational vehicle park.
Limited Manufacturing	I-1	Warehousing, fabrication, light industry, retail and wholesale sales.
Medium Industrial	I-M	Limited manufacturing, warehouse and distribution, and science-related research and development.
Heavy Manufacturing	M-2	Heavy manufacturing, warehousing, and related uses.
Public Reserve	PR	Parks, public and semi-private uses.

CITY OF RICHLAND

WELLHEAD PROTECTION DELINEATIONS AND LANDUSE



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06-10-97

Floodplain, Agriculture, and Public Reserve

These land uses are limited within the WHPAs.

Residential

Most of the WHPAs consist of residential property uses. These properties vary from small, single-lot homes to higher density, multi-family complexes. The majority of these areas are served by the City's sanitary sewer system.

Commercial

Commercial land use areas are limited to George Washington Way, Wellsian Way, Jadwin Avenue, and Stevens Boulevard. The proximity of these areas to the WHPAs may be a cause of concern for the City. State Highway 240 passes through the 1- and 5-year WHPAs of the Wellsian Wellfield and the 5-year WHPA of the Duke Wellfield. Interstate 182 crosses within the 1-year WHPA of the Wellsian Wellfield. Release of contaminants to the subsurface from facilities located in these areas could migrate to the wellfields in less than one year.

Industrial

Industrial land use areas are limited within the WHPAs. The location of these land use areas are within the 1- to 5-year WHPAs of the North Richland Wellfield along Stevens Boulevard, within the 1- to 10-year WHPAs of the Duke Wellfield also along Stevens Boulevard and at the Richland Airport, and within the 1- to 10-year WHPAs of the Wellsian Wellfield along Interstate 182, State Highway 240, and Wellsian Way. Because these industrial areas are not currently fully-developed, any future development may pose a risk to those WHPAs.

Future Changes in Land Use

Future changes in land use will need to be evaluated on a site-by-site basis especially with respect to point sources such as service stations, dry cleaners, and chemical handling facilities.

Contaminant Source Inventory Database

The City's contaminant source inventory was completed using data from two origins: 1) state and federal databases, and 2) windshield and personal interviews. The state and federal databases queried for addresses within the WHPAs were:

- United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) list
- USEPA Subtitle 1/Washington State Department of Ecology (WDOE) Registered Underground Storage Tank (UST) list
- USEPA Superfund Amendments and Reauthorization Act (SARA) list
 - Toxic release
 - Chemical handling - small, medium, and large amounts
- WDOE Underground Injection Control (UIC) Program list

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Due to the characteristics of the City and the location of the wellfields, potential groundwater contaminant sources within the WHPAs include: USTs, spills at chemical handling facilities, urban runoff, and transportation spills.

The results from the database searches were verified in the field by a windshield survey and a personal interview, if allowed, by the property operator/owner. Any errors in the database were corrected by City staff, including deletions and additions. The final list of potential contaminant sources is included as Appendix C.

The City of Richland's business license database may also be queried by category (or Standard Industry Code (SIC) code, in the future) to allow the user to identify other potential contaminant sources that may not be included on federal or state databases. However, it should be noted that the City does not require business licenses from schools or local, state, or federal governmental agencies. This data will be added to the contaminant source inventory by City staff during the inventory update.

Potential Contaminant Source Evaluation

To evaluate the results of the contaminant source inventory, potential sources were categorized to obtain a listing of the potential chemicals that could be used at a facility. Existing work completed in Spokane County (Miller 1995) was used for this categorization (see Appendix D). Miller identified 27 critical material user groups (CMUs) — dry-cleaning, paint/auto body shops, gasoline-retail, etc. Each CMU designation includes a listing of chemicals that may be in use at the facility. The City of Richland's business licenses contain category designations depending on the type of business. This information was entered into a spreadsheet along with a cross-classification using the CMU identifiers. Businesses in the database can be correlated with a listing of potential chemicals using Miller's work. Miller's business classes and listing of chemicals are also included in Appendix D.

Miller states that there is a correlation between the SIC and the CMU classification. SICs were not obtained during this study, but updates to the contaminant source inventory (business license database) could incorporate this correlation in determining CMU classifications. When a new business is added to the list with a SIC listing, a corresponding CMU can be assigned. This action could then trigger varying responses depending upon the groundwater management strategies employed by the City (see Chapter 4).

Figure 3-2 presents a flow chart of the database envisioned for linking with the City's GIS. The primary field in the database is the address key. This flow chart also illustrates how the City may query their business licenses for uniform business Identification (UBI) numbers for cross-referencing with state and federal databases. The business license database will also serve to identify businesses that the Fire Department or Pretreatment Officer will want to review for critical materials during inspections.

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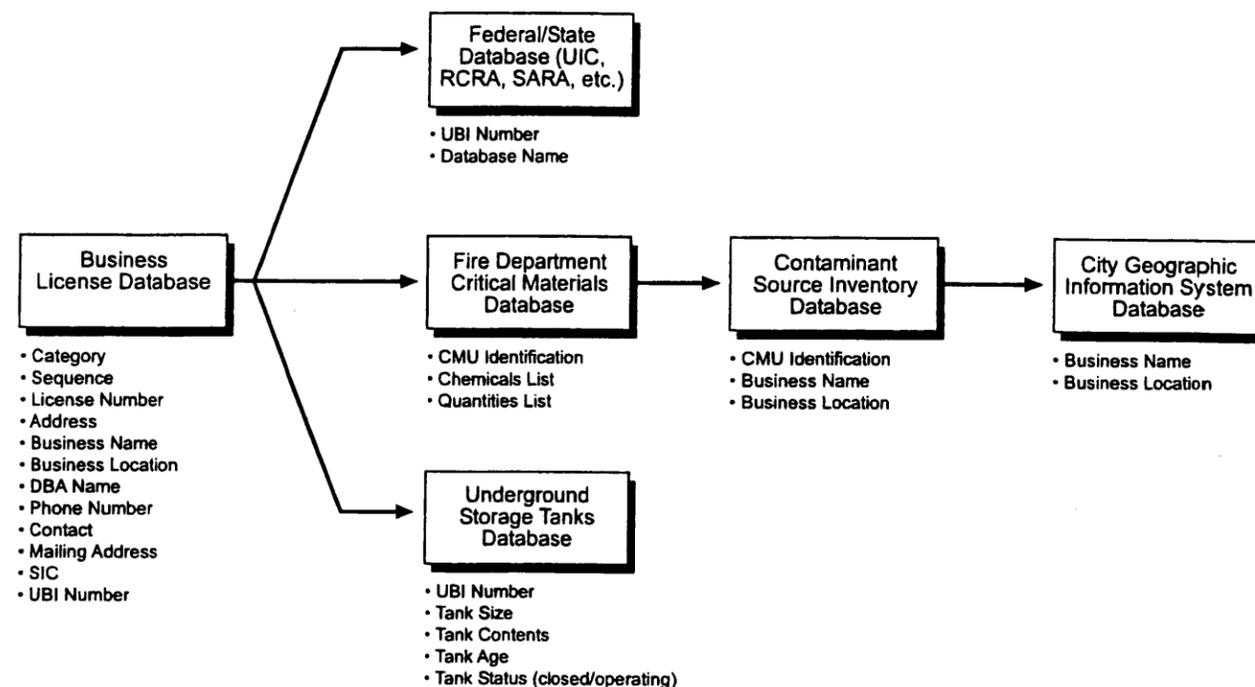
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Figure 2 - Database Flow Chart

Richland Wellhead Protection Plan - Contaminant Source Inventory



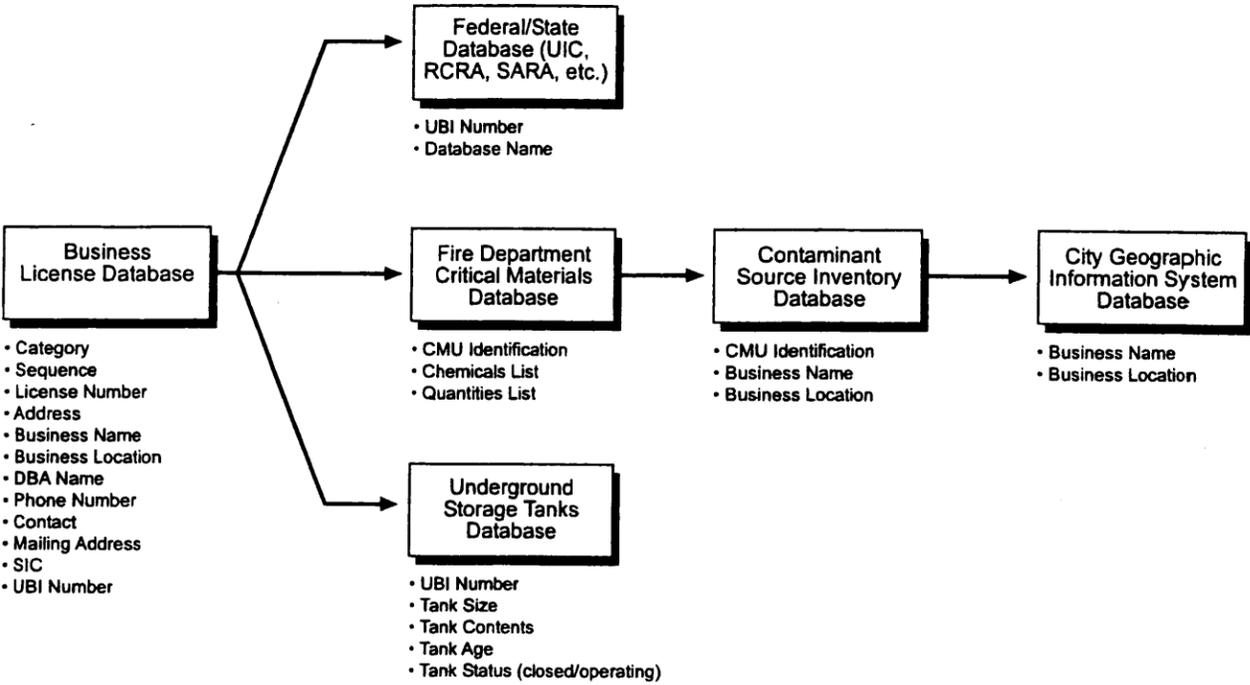
Potential Contaminant Sources

A total of 333 potential contaminant sources were identified within the WHPAs that includes the 1-, 5-, and 10-year times of travel (TOT). In managing risks to a groundwater supply, the immediate risk is proximity. The closer the source to the wellhead, the greater the potential for source contamination. Table 3-3 lists the potential contaminant sources by CMU classification and business license category. Appendix C includes a definition of these business class category designations.

Of the 333 potential contaminant sources, 19 of the facilities are closed. Seventy potential sources (four of which are closed) could not be assigned to a business class because a direct correlation could not be made based upon the business name. During updates of business license database (which is the basis for the contaminant source inventory), these assignments can be made by City staff. Of those 70 potential sources, ten facilities (two closed) are within the 1-year WHPA, and 15 facilities (one closed) are within the 5-year WHPA. Appendix A includes the CMU classification of each potential source in the farthest right column. Those businesses without a CMU classification were assigned an identification code of -99.

Table 3-3 indicates many of the sources are related to automobile servicing and fueling. Of those classified businesses, 106 conduct business related to automobiles. Many of these facilities operate underground storage tanks for gasoline or other petroleum products. Also indicated by Table 3-3 is that eight dry-cleaning facilities occur within the WHPAs. These facilities are known to handle chlorinated organic solvents that have been the source of groundwater contamination in

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other parts of Washington State. Miller contains a short list of chemicals that may be used at dry-cleaning facilities.

Table 3-3. Potential Contaminant Sources by Business Class

Business Class Title	CMU ID	Business License Category	Number of Sites
UNASSIGNED	-99		70
Art Materials and Supplies	1	C21	2
Auto Repair, Parts, Machine Shops, Service	2	C01, C10, C14, F02, F05, F06, F07, F10, F20	60
Batteries, Retail - Wholesale	3	F07	4
Boat Repair and Cleaning	4	C14	7
Building Materials Production and Sales	5	C07	20
Wood Preserving	6		
Building Maintenance, Cleaning Supplies, Manufacturing and Distribution	7	C14, F15	4
Dry-cleaning Facilities	8	F14	8
Electrical and Electronics Products and Manufacturing	9	C20, F01, F03, F05	7
Electroplating	10		
Foundries	11	F01	1
Furniture Refinishing	12	F05	1
Garden Centers, Greenhouse Equipment and Supplies	13	F02	2
Landscaping, Horticulture Services	14	F05	5
Gasoline, Retail	15	C14, C19	36
Hardware, Retail	16	C03, C06, C10, C14, F05	20
Medical Facilities, Laboratories, Hospitals	17	All As, B05, F01, F03, F04, F05	42
Metal Fabrication	18	F01, F03	4
Paint/Auto Body Shops	19	F05, F07	10
Photo Processing and Supplies	20	B02, F05	11
Plastics and Fiberglass Manufacturing and Use	21		1
Printing	22	F05, F25	5
Radiator Repair	23		
Seed Cleaning and Treating	24		
Solvent Recycling	25	F24	4
Trucking Companies	26	F05	5
Water Softener Sales and Service	27	F03, F05, F13	4
		TOTAL	333

Other Potential Contaminant Sources

In addition to industrial and commercial facilities, it is also possible that other potential contaminant sources exist, such as transportation spills and stormwater discharges to the subsurface. As indicated, most of the areas within the WHPAs are served by sanitary sewers; thus, on-site waste disposal systems are not considered a source of groundwater contamination.

Transportation corridors exist in proximity to the City's wells. State Highway 240 passes within the 1- and 5-year WHPAs of the Wellsian Wellfield and the 5-year WHPA of the Duke Wellfield. Interstate 182 passes within the 5-year WHPA of the Duke Wellfield. Upon these corridors, as well

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Batteries, Retail - Wholesale	3	F07	4
Boat Repair and Cleaning	4	C14	7
Building Materials Production and Sales	5	C07	20
Food Preserving	6		
Building Maintenance, Cleaning Supplies, Manufacturing and Distribution	7	C14, F15	4
Dry-cleaning Facilities	8	F14	8
Electrical and Electronics Products and Manufacturing	9	C20, F01, F03, F05	7
Electroplating	10		
Foundries	11	F01	1
Furniture Refinishing	12	F05	1
Garden Centers, Greenhouse Equipment and Supplies	13	F02	2
Landscaping, Horticulture Services	14	F05	5
Gasoline, Retail	15	C14, C19	36
Hardware, Retail	16	C03, C06, C10, C14, F05	20
Medical Facilities, Laboratories, Hospitals	17	All As, B05, F01, F03, F04, F05	42
Metal Fabrication	18	F01, F03	4
Paint/Auto Body Shops	19	F05, F07	10
Photo Processing and Supplies	20	B02, F05	11
Plastics and Fiberglass Manufacturing and Use	21		1
Printing	22	F05, F25	5
Radiator Repair	23		
Seed Cleaning and Treating	24		
Solvent Recycling	25	F24	4
Trucking Companies	26	F05	5
Water Softener Sales and Service	27	F03, F05, F13	4
		TOTAL	333

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as other arterial roadways in the City of Richland, hazardous materials are transported that may result in chemical spills entering the subsurface. Dry wells that are used, although infrequent, increase the potential for a hazardous material spill to enter the subsurface. Transportation of hazardous materials along roadways and the use of dry wells are also areas of risk for contamination to Richland's groundwater.

It is possible for spills occurring on commercial and industrial properties to enter dry wells and contaminate groundwater. The City may want to undertake an inventory of dry wells and determine methods to contain their runoff and discharge using non-dry well methods. Figure 3-3 (three maps) provides storm drainage system mapping for the City, but does not illustrate dry wells, bioswales, or other non-piped surface flow.

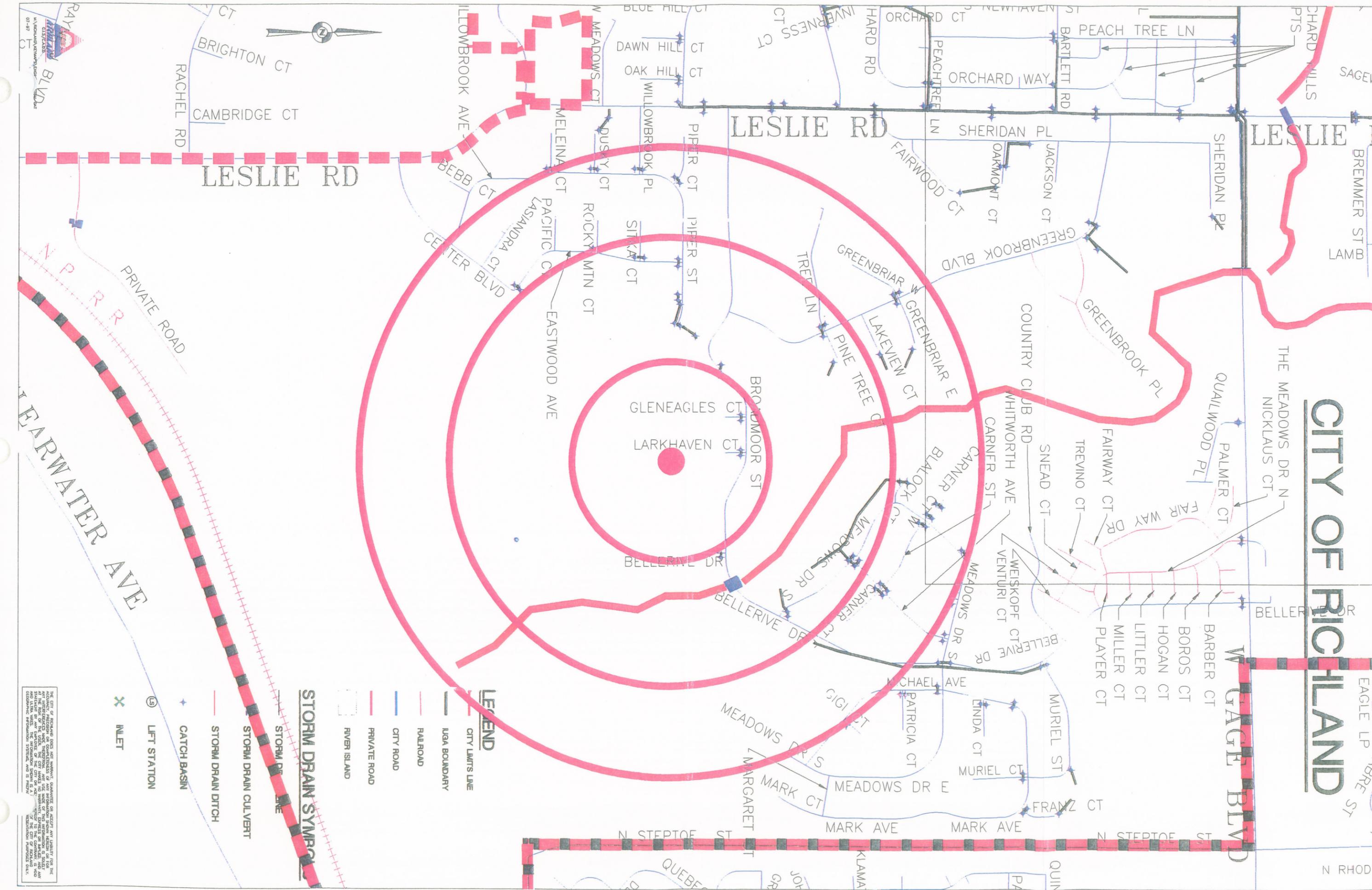
General Risk Evaluation

Based on the results of the CMU designations and other information presented, a qualitative assessment on the risks of groundwater contamination in the WHPAs can be made. This assessment is subjective, as it is not possible or practical to technically analyze the risk posed by each potential contaminant source. The potential sources of contamination that appear to present the greatest risk to the wellfields are:

- Commercial facilities (that handle critical materials) located within the WHPAs. Mishandling of these chemicals may result in contamination of groundwater. Users of chlorinated solvents may present the highest risk of these potential sources.
- Underground storage tanks exist at many locations within the WHPAs. Leakage from these tanks may result in groundwater contamination. However, evidence suggests the petroleum fuels are naturally attenuated in the subsurface and may have a lower risk of contamination than other chemicals.
- Transportation of hazardous materials may lead to subsurface discharge of spills. Spill materials reaching the subsurface may result in groundwater contamination.
- The use of dry wells on commercial and industrial properties may lead to groundwater contamination, should spilled chemicals enter these facilities. Operation of dry wells without routine maintenance presents a risk to groundwater quality.

This qualitative assessment does not include risks attributed to vandalism or other actions intended to criminally contaminate the public water supply. Of specific concern is the North Richland Wellfield and the impoundment of river water. These risks are known to exist, but are not addressed by this report.

CITY OF RICHLAND



- LEGEND**
- CITY LIMITS LINE
 - UGA BOUNDARY
 - RAILROAD
 - PRIVATE ROAD
 - CITY ROAD
 - RIVER ISLAND

- STORM DRAIN SYMBOLS**
- STORM DRAIN CULVERT
 - STORM DRAIN SYMPLECTIC
 - STORM DRAIN LINE
 - STORM DRAIN DITCH
 - + CATCH BASIN
 - 9 LFT STATION
 - x INLET

THE CITY OF RICHLAND HAS NOT BEEN AWARE OF ANY CHANGES TO THE CITY LIMITS LINE SINCE THE LAST REVISION OF THIS MAP. THE CITY OF RICHLAND HAS MADE THIS MAP TO THE BEST OF ITS KNOWLEDGE AND BELIEF. THE CITY OF RICHLAND HAS NO LIABILITY FOR ANY ERRORS OR OMISSIONS. THE CITY OF RICHLAND HAS NO LIABILITY FOR ANY DAMAGES, INCLUDING REASONABLE ATTORNEY'S FEES, ARISING OUT OF OR FROM THE USE OF THIS MAP. THE CITY OF RICHLAND HAS NO LIABILITY FOR ANY DAMAGES, INCLUDING REASONABLE ATTORNEY'S FEES, ARISING OUT OF OR FROM THE USE OF THIS MAP.



CITY OF RICHLAND

SIEMENS

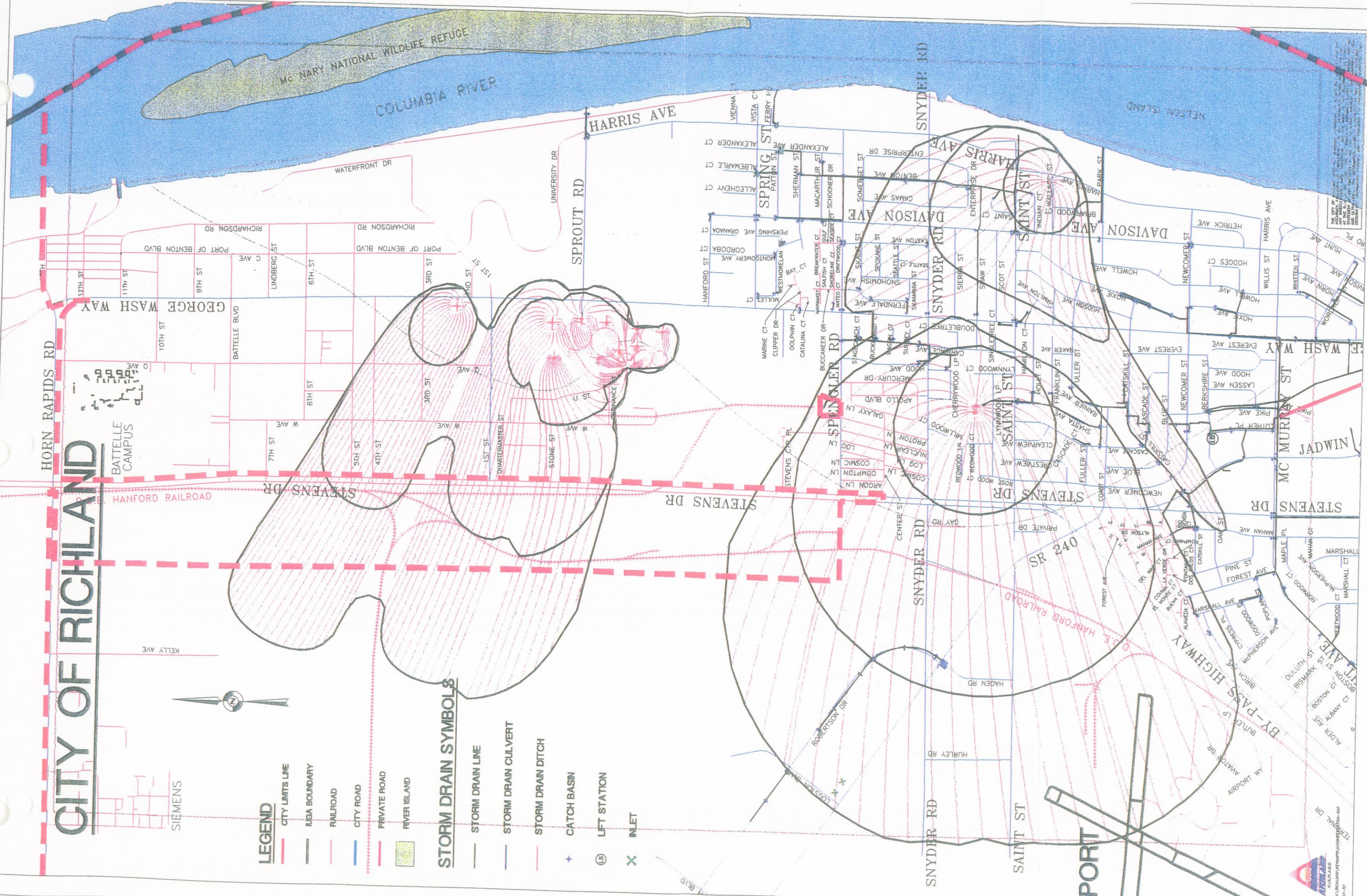


LEGEND

- CITY LIMITS LINE
- IGA BOUNDARY
- RAILROAD
- CITY ROAD
- PRIVATE ROAD
- RIVER ISLAND

STORM DRAIN SYMBOLS

- STORM DRAIN LINE
- STORM DRAIN CULVERT
- STORM DRAIN DITCH
- CATCH BASIN
- LIFT STATION
- INLET

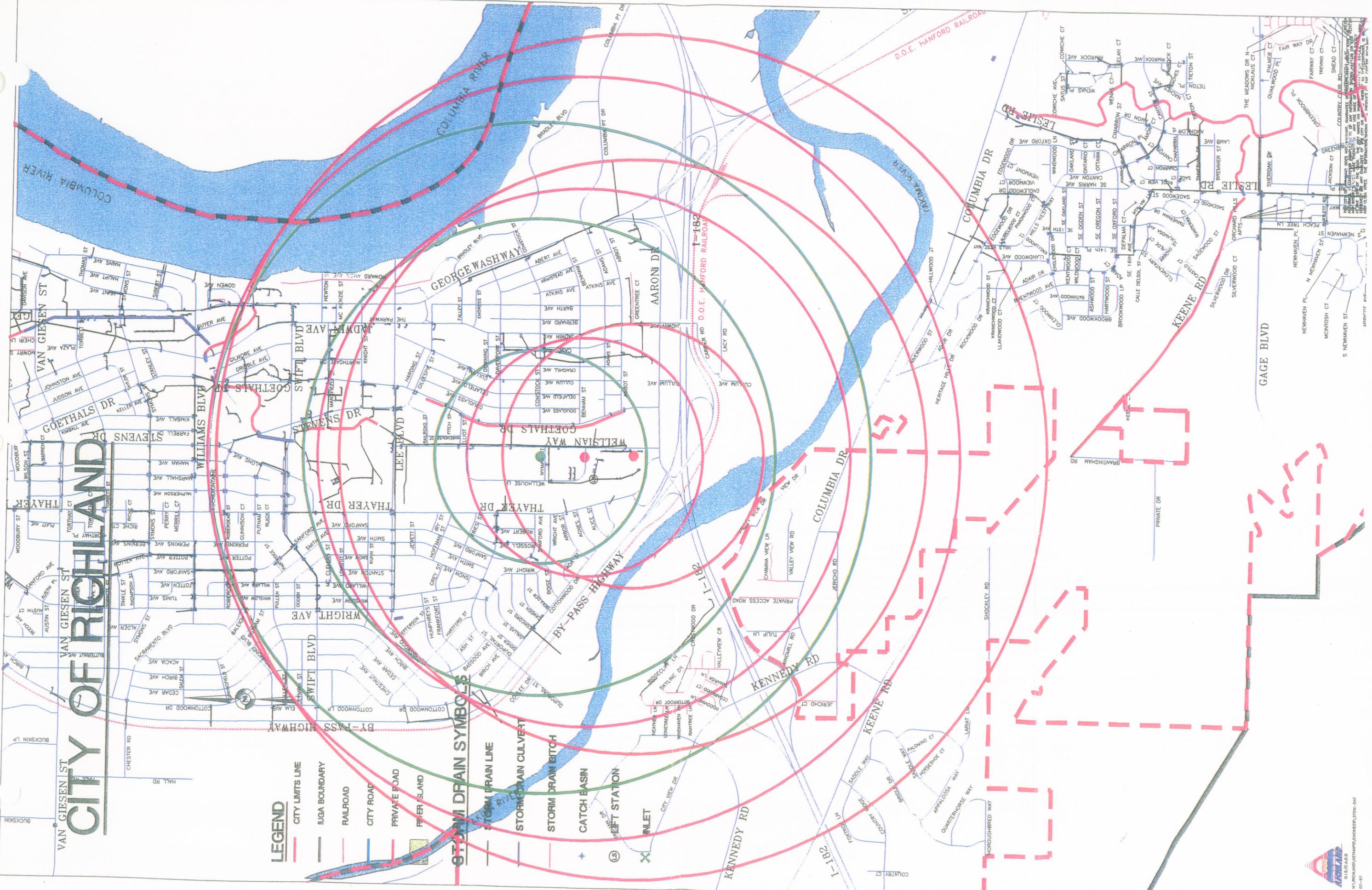


MAINTENANCE DIVISION
01-27

CITY OF RICHLAND

LEGEND

-  CITY LIMITS LINE
-  IUGA BOUNDARY
-  RAILROAD
-  CITY ROAD
-  PRIVATE ROAD
-  RIVER ISLAND
-  STORM DRAIN SYMBOLS
-  STORM DRAIN LINE
-  STORM DRAIN CULVERT
-  STORM DRAIN DITCH
-  CATCH BASIN
-  LIFT STATION
-  INLET



Contaminant Source Inventory Update

The contaminant source inventory is required by WDOH to be updated every two years. The City will supply the appropriate City staff and the Fire Department with a copy of the CMU designations and potential critical materials list by business type. As part of their facility inspections, the City will verify or recategorize the site, quantify the critical materials on site, and identify the largest size of each container.

The City's GIS system will incorporate the SIC/CMU/business license category designation for facilities. The WHPAs will be part of the business license database. Using these mechanisms, City Public Works will be able to be notified when a business is applying for a license within the WHPAs, and the City will be able to query the database for potential contaminant sources by category or CMU designation.

CHAPTER 4

GROUNDWATER MANAGEMENT STRATEGIES

Introduction

Implementation of pollution prevention and risk reduction strategies will enable the City to adequately protect their groundwater supplies. Effective implementation of the wellhead protection plan utilizes all levels of agencies — local, state, and federal — to coordinate wellhead protection activities. The purpose of this chapter is to develop these groundwater management strategies, including budgetary costs for implementation.

Designation of Wellhead Area

The identification and designation of wellhead protection management areas (WHPAs) are fundamental to the development of all other management strategies. With this designation, the City will be able to direct their focus on the potential contaminant sources that are of the greatest threat to their groundwater supplies. It also provides a defensible stance if the City is to develop special permitting or regulatory requirements within the WHPAs. These WHPAs are:

- One year time of travel;
- 1 - 5 year time of travel; and
- 5 - 10 year time of travel.

The City will work with legal counsel and planning to develop legal descriptions designating the WHPAs based upon the delineations. These WHPAs will be the building blocks upon which all other management strategies will rely. With the Wellhead Protection Committee (WHPC) and City planning, the City will develop policy statements for pollution prevention and risk reduction within the WHPAs. The closer the WHPAs are to the wellheads, the more restrictive the strategies and policies should be.

Recommended Wellhead Protection Strategies

Management of WHPAs can be categorized as regulatory and non-regulatory. A number of these strategies have been developed over the years as groundwater contamination awareness has grown. To be considered in selection of appropriate strategies for Richland are the following:

1. The City already has several environmental programs — sewer pretreatment, business outreach, moderate risk waste, household hazardous waste — and policies that may overlap with respect to groundwater protection response. The goal of this plan is to provide the tools to, and framework for, implementing strategies that are viable, not to re-invent those that already exist.

2. Public information is key to the success of source inventory updates, local emergency response, best management practices (BMPs), etc. When the community's awareness is heightened, the ability to implement strategies and to obtain funding is increased.
3. To protect groundwater sources from current and future activities, the City will need to consider compromises between levels of spending and levels of protection.

Applicable strategies for the City of Richland are:

- **Public Awareness** - piggyback onto existing programs, erection of signs along roads identifying the boundaries of WHPAs, press and media coverage, workshops for council members, elected officials, school children.
- **Source Inventory** - maintain inventory and update at least every two years, integrate with City's GIS system as applicable. Document notification of businesses and regulatory agencies.
- **Contingency and Spill Response Planning** - prepare contingency plan and update emergency response plan to reflect groundwater and surface water (for North Richland wellfield) threats within WHPAs
- **Permitting Controls and Design/Construction Standards** - UST conformance, spill containment barriers, notification of Conditional Use Permits within WHPAs.
- **Hazardous Chemicals Handling Regulations** - spill reporting and inspections within WHPAs.

Non-Regulatory Management Recommendations

These management recommendations are intended to reach a broad range of the community. For implementing these options, the City will be seeking community cooperation to protect their water sources.

Public Awareness

Public awareness can be used to build support for regulatory efforts or to implement voluntary protection efforts such as, hazardous waste collection, waste oil collection, and water conservation. Public information about groundwater protection can include: press releases; press conferences; newsletters; meetings and workshops; voluntary committee work, and brochures.

A. Road signs in Wellhead Protection Areas. The erection of signs announcing entry into WHPAs along local roads and highways is a simple, but effective tool for making the public aware of their drinking water supplies. Signs will be erected at the boundaries and within the WHPAs.

B. Large signs or bulletin boards in public places. Erect large signs or bulletin boards describing hydrogeology and groundwater contamination potential within the City. Place these signs in public places including parks, golf courses, etc. Place these signs on collection receptacles used during the Spring Clean-up Collection Event.

C. Booklets for specific businesses in Wellhead Protection Areas. Identify businesses within the WHPA zones such as gasoline service stations, dry cleaners, or other small businesses that are likely to engage in activities or handle hazardous substances that are subject to regulation. Develop booklets or pamphlets about contaminant minimization and roles of businesses within the WHPAs.

Present these at business workshops as described in subsection D. The Wellhead Protection (WHP) coordinator or designee will make personal visits to each of these businesses to promote the Wellhead Protection Plan (WHPP), take questions, invite them to the workshops, and drop off the educational booklets or pamphlets.

D. Workshops for specific businesses in Wellhead Protection Areas. Present booklets and other materials at local workshops where the WHP coordinator and City staff can work with local businesses to identify means of decreasing potential onsite contaminants or installing BMPs. Public Information Officer to place advertisements in local newspapers regarding measures to be implemented for businesses operating within WHPAs.

E. Public information packets. Develop brochure/workshop material on: i) the origin of groundwater as a drinking water source; ii) pathways of groundwater to wells; iii) what are sources of contamination within the WHPAs; iv) how to reduce household hazardous waste. Present these materials at local business meetings such as the Chamber of Commerce, Rotary, or other service organizations. WHP coordinator to work with Public Information Officer to place advertisements in local newspapers regarding these issues. Include in the press releases a calendar for adoption of WHPA designations and opportunities for public input.

F. Permitting packets. Provide permit applicants a packet containing a summary of the WHPP, mapping, and planning considerations.

G. Work with Moderate Risk Waste Facility for Household Hazardous Waste (HHW) and Small Quantity Generators (SQG). Continuing to support the collection of household hazardous wastes within the City of Richland is very important. Program funding for the collection of these wastes yearly at the Spring Clean-up collection event, a satellite collection facility, and the permanent Benton County Moderate Risk Waste Facility are essential. The continued development of the small quantity generator (SQG) program to help commerce and industry dispose of moderate risk wastes reduces the risk that these chemicals will enter the ground. WHP coordinator will work with Solid Waste staff to place signs on dumpster collection sites as described in subsection B.

H. Employee awareness. Conduct workshops with Water Division and other Public Works employees to make them aware as to the location of the WHPAs and the appropriate response/cleanup procedures.

Contaminant Source Inventory

As part of the WHPP, an inventory of all potential sources of groundwater contamination within the WHPAs is required. The City is required to maintain and update this inventory at least every two years. The City will want to integrate inventory information into the City's current GIS system. Coordinate with the Fire Department, Business Licensing, Planning, and Washington State Department of Ecology to provide amendments to the inventory as agency databases are updated, business licenses are approved, and as site plans are reviewed and approved.

A. GIS database maintained. Maintain the inventory on a database that can be integrated with the City's GIS system. Update the inventory every two months; at a minimum, every two years as required by WDOH.

B. Notification to sources of potential contamination. As new potential contaminant sources are identified, the WHP coordinator will notify the potential sources as well as the agency having regulatory responsibility. The WHP coordinator will maintain documentation of notifications.

Contingency and Spill Response Planning

Although contingency planning is a required component of the WHPP, it is included as a management strategy because it should be considered in tandem with all the other groundwater protection mechanisms. Contingency and spill response planning identifies the threats to groundwater supplies, determines the appropriate responses, and assesses responsibilities of carrying out those responses.

A. Preparation of plans. WHP coordinator will keep the City's *Contingency and Spill Response Plan*, and provide information to keep the Benton County *Emergency Operations Plan* current. City staff will inform and train the local responders. Use local newspapers to promote the need for spill response planning. Provide press coverage of examples of agency cooperation, case histories, and recognition of emergency response personnel and records.

B. Updating emergency plans. Updates in potential contaminant threats, new technology, and approaches to intercept or mitigate contamination, or changes in suppliers, sources of assistance, personnel, agencies, and their phone numbers and addresses will be reflected in these plans. The WHP coordinator will be responsible for updating these plans.

C. Integrate efforts with Fire, Police and Emergency Services. WHP coordinator will conduct workshops with other City departments to ensure responders know the location of WHPAs and appropriate response/cleanup procedures. The City will require first responders to notify the Public Works Department - Water Division as to any spill within the WHPAs. WHP coordinator will inventory first responder cleanup equipment to ensure appropriateness – neutralizing agents, absorbent socks, foam, booms, and test kits. The City will provide appropriate additional cleanup equipment for first responders to use. The WHP coordinator will develop appropriate cleanup procedures for spills within the WHPAs and communicate those to first responders and CHEMTREC.

Regulatory Management Recommendations

These management recommendations are intended to focus more on engineering standards and administration rather than community cooperation; thus, making them more of a regulatory control. Revise the Richland Municipal Code (RMC) to give the Engineering and Utility Services Director (EUSD) authority to protect groundwater associated with the WHPAs. Within his general responsibilities, the EUSD will adopt the WHPP within the Richland Administrative Code (RAC).

Overlay Zone

Overlay zoning will be used to delineate the WHPAs and to adopt specific regulations for the protection of those areas. The WHPAs will be based upon Chapter 2 of this report, but will need to have legal descriptions for the overlay zone ordinance. Due to the non-linear shape of the WHPAs,

modified WHPAs will be made by City staff. Management policies developed for these WHPAs will focus on long-term strategies.

Due to changes in the groundwater flow system, the boundaries of the WHPAs may change and will be periodically reviewed by the WHP coordinator and City staff. The RMC will be amended by ordinance to recognize the following WHPAs:

- One year time of travel;
- 1 - 5 year time of travel; and,
- 5 - 10 year time of travel.

A. *Appoint a Wellhead Protection Coordinator.* The EUSD will appoint a WHP coordinator who will be responsible for the implementation of the WHPP. The WHP coordinator will also be the primary contact at the City regarding wellhead protection.

B. *Create overlay zone for Wellhead Protection Areas.* The overlay zoning will be used to target changes to the WHPAs and will allow uses outside the overlay zone to continue.

C. *Maintain a Wellhead Protection Committee.* The WHPC will be used to address wellhead protection issues and to develop policy affecting the WHPAs.

Permitting Controls

The City regulates a variety of development activities that can affect groundwater based upon building, health, fire and sanitary codes, examples of which are: conditional use permits (CUP), site plan approvals, and business permits. These existing tools can be used to ensure compliance with WHPA regulations.

A. *Conditional use permits.* During the facility permitting process, any requests for CUPs within the WHPAs will trigger automatic notification to the WHP coordinator, and appropriate investigation into the nature of business will be assessed. The City will begin a program to notify the WHP coordinator upon receipt of request for a CUP within the WHPAs.

B. *Site plan approval process.* The City will use its existing site plan approval process to enable planning to determine if the proposed development is compatible with the existing land use, including overlay zoning. It will also allow the WHP coordinator and City staff to review and enforce the design and construction standards that may apply if the development is within the WHPAs. A list of WHPA plan comments will be compiled for both Planning and Public Works that can be referenced during the review process by the WHP coordinator.

By reviewing the type of building and its intended use, the WHP coordinator will be able to identify potential future contaminants that might be used onsite. Evaluation of the site plan will also determine the need for mitigation requirements such as oil/water separators, spill and drainage containment, or other BMPs. Comments from Planning or Public Works that may affect WHPAs will be forwarded to the WHP coordinator for inclusion in the database and consideration of appropriate actions.

C. *Business license review process.* Use the existing business license review process to enable the WHP coordinator and City staff to determine if the business and its practices pose a risk to the

WHPAs. Information gathered during this process will be added to the contaminant source inventory and GIS database.

Design and Construction Standards

Design and construction standards can be used to ensure that new buildings or structures placed within the WHPA are designed and constructed in such a manner as to reduce their threat to the WHPAs.

A. *Spill containment barriers.* The WHP coordinator or other City staff will review spill control BMPs for facilities within the WHPAs to minimize the potential for contamination — proper location of emergency spill kits and equipment, use of wet-vacuum, use of earthquake-proof containers, and their location within the facility, etc. The City may decide to prepare design standards for spill containment barriers.

B. *Underground storage tank conformance.* The City will review and evaluate a special permitting process to evaluate risks posed by underground storage tanks (USTs). Those items to be considered for tank regulations are: leak testing and construction standards for new, large tanks, removal of existing residential USTs, and prohibition of all new USTs (unless they have appropriate safeguards) within the WHPAs. As part of the UST review, the City will evaluate risk associated with new tank requests and only allow them within WHPAs if required by fire code. USTs are regulated by the Fire Department and the state respectively. Outside City limits, the City may need the cooperation of Benton County to implement UST conformance.

Toxics and Hazardous Materials Handling Regulations

Since the use and handling of toxics and hazardous materials within the WHPAs pose a significant threat to the WHPAs, the City will need to coordinate inspections of facilities and requirements for spill reporting.

A. *Spill reporting.* The WHP coordinator and Public Works will be notified of all spills within the WHPAs by the responding agency. Presently, only Ecology receives notification. Public Works needs to educate its employees as to proper procedures when receiving a call from the first responders.

B. *Inspections.* The City has the authority to inspect any facility at any normal operating time for conformance to standards for use, handling, production, and storage of toxic or hazardous materials. The City, through the Fire Department, will train their employees as to what to look for when completing their fire prevention and outreach inspections.

Transportation of Hazardous Materials

As stated in the Benton County Emergency Operations Plan, the transportation of hazardous materials through Benton County by rail and road creates a significant hazard due to their frequency and quantity. After a facility is sited, there will be many state and federal regulations governing the use, storage, and transport of hazardous materials, and the penalties are straightforward, such that additional policy may not be needed.

A. Placards on vehicles transporting hazardous wastes. Communicate with the Police Department that all cargoes containing hazardous materials are required to be placarded according to state and federal regulations. Continue to enforce this policy using law enforcement within the City limits and County enforcement outside the City limits.

B. Integrate spill response with first responders. The City will contact all first responders and request that the WHP coordinator or other designee be notified of any spill occurring within the City limits.

Estimated Implementation Costs

Preliminary estimate of WHPP management implementation costs were developed with City staff. These costs and their basic assumptions are shown in Table 4-1. The steps for implementing these recommendations will be included in a City-prepared funding and implementation plan. This plan will include:

- responsible agency for implementation;
- detailed cost breakdown for implementation;
- detailed description of the elements of the implemented recommendation;
- schedule for and duration of implementation; and,
- mechanism to monitor implementation success.

Summary

This initial WHPP starts with the basics of public awareness, source inventory, contingency planning, creation of overlay zones based upon time of travel of contaminants to the source wells, and implementing certain design and construction standards. The irony of wellhead protection is that success is measured by *what didn't happen*.

Too often people feel the need to point to tangible things to gauge the effectiveness of their investment. Effective implementation of a WHPP is facilitated by exercising existing municipal authorities and a community-based committee structure to set up a program that performs these items: awareness, inspections, permitting, overlay zoning, and emergency planning. By employing this structure and control at the *local* level, the City serves notice that the WHPP is a *real* program that makes good common sense, and that persons responsible for sources or activities within the WHPAs which may be potential threats to the groundwater may be held accountable in managing these sources and activities effectively. WHPP can benefit the City by safeguarding the public health as well as ensuring economic viability for the community on a long-term basis through a *preventative and proactive approach* to protecting their groundwater supplies.

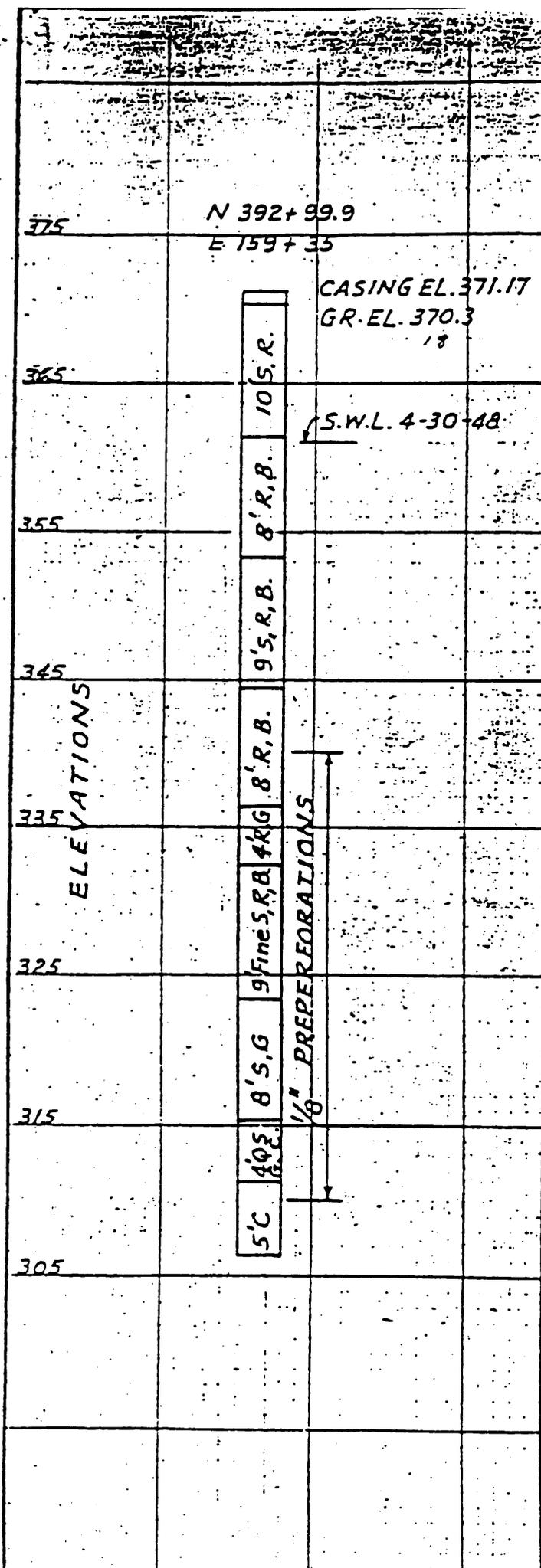
Table 4-1. Estimated Costs for WHPP Recommendations

ACTIVITIES	COSTS	ASSUMPTIONS
Non-Regulatory Recommendations		
<i>Public Awareness</i>		
A. Road signs in WHPAs	\$5,000	Install 25 road signs.
B. Large signs or bulletin boards	\$6,000	Install 6-4'x8' bulletin boards.
C. Booklets for specific businesses	\$8,000	Prepare from existing materials. Print and distribute.
D. Workshops for specific businesses	\$3,000	Five half-day workshops facilitated by WHP coordinator.
E. Public Information packets	\$10,000	Select from existing materials. Print and distribute.
F. Permitting packets	\$3,000	WHP coordinator to prepare. Print, distribute with permits.
G. Household hazardous waste collection	\$4,000	Adds one collection drive. Includes advertisements by City reader board, newspapers, radio, and television.
H. Employee awareness	\$1,000	Two half-day workshops facilitated by WHP coordinator. Does not include labor of attendees.
SUBTOTAL	\$40,000	
<i>Source Inventory</i>		
A. Maintain GIS database	\$6,000 per year	Update database every two months. Update source inventory to WDOH every two years.
B. Notification to potential contaminant sources	\$5,000 per year	Prepare simple brochure and distribute by mail.
SUBTOTAL	\$11,000 per year	
<i>Contingency and Spill Response Planning</i>		
A. Preparation of plans	\$25,000	Prepared by consultant. Updated by WHP coordinator.
B. Update emergency plans	\$2,500 per year	Provide review and update of existing plans by WHP coordinator.
C. Integrate efforts with Fire, Police, and Emergency Services	\$1,000	Two half-day workshops facilitated by WHP coordinator.
SUBTOTAL	\$26,000 plus \$2,500 per year	
Regulatory Recommendations		
<i>Overlay Zone</i>		
A. Appoint a WHP Coordinator	\$26,000 plus \$20,000 per year	Start-up. Salary and benefits for 1/3 of a FTE City employee. 1/4 FTE for program maintenance.
B. Create overlay zones for WHPAs	\$10,000	Preparation of wellhead protection ordinance by consultant and City staff.
C. Establish WHPC	\$1,000	City to appoint committee.
SUBTOTAL	\$37,000 plus \$20,000 per year	

Table 4-1. Estimated Costs for WHPP Recommendations (continued)

ACTIVITIES	COSTS	ASSUMPTIONS
<i>Permitting Controls</i>		
A. Conditional use permits	\$5,000	Applies to initial coordination of review process. Review labor is included in Overlay Zone.
B. Site plan approval process	\$5,000	Applies to initial coordination of review process. Review labor is included in Overlay Zone.
C. Business license review process	\$5,000	Applies to initial coordination of review process. Review labor is included in Overlay Zone.
SUBTOTAL	\$15,000	
<i>Design and Construction Standards</i>		
A. Spill containment barriers	\$2,500	WHP coordinator to review City BMPs. May require new standard details and specifications.
B. UST conformance	\$5,000	Review state regulations. Determine if additional measures are needed. Inspections performed as part of facility inspections.
SUBTOTAL	\$7,500	
<i>Toxics and Hazardous Materials Handling Regulations</i>		
A. Spill reporting	\$1,000	Provides for coordination of notification by City staff.
B. Inspections	\$2,500	Two half-day workshops with Fire Department - up to three attendees.
SUBTOTAL	\$3,500	
<i>Transportation of Hazardous Materials</i>		
A. Placards on trucks	\$1,000	Provides for coordination with City Police.
B. Integrate spill response with First Responders	\$1,000	Provides for coordination of notification by First Responders
SUBTOTAL	\$2,000	
TOTAL	\$131,000 plus \$33,500 per year	

**APPENDIX A
WELL LOGS**



WELL DATA

20" steel casing. Pre-perforated from Elev. 310 to 340. Static water level after surging and before pumping Elev. 360. Sandfree in 10 minutes after first pumping. Pumped 1100 to 2000 GPM for 12 hours drawdown 6.5 to 14.5 ft. Specific capacity at 1100 GPM - 170, at 2000 GPM - 138. 1,000 GPM, 6 stage Pomona pump, head 250 ft., set at Elev. 318.5.

KEY

- B Boulders
- C Clay
- FS Fine sand
- G Gravel
- R Rocks
- S Sand

SCALE: 1"=10'

APPROVED _____ DATE 8-20-48 DRAWN BY Q
 CHECKED BY Q

GENERAL ELECTRIC CO.
 HANFORD WORKS
 ALVORD, BURDICK & HOWSON
 CONSULTING ENGINEERS CHICAGO

LOG OF WELL-3000-C

DWG. NO. 4-11-110-

WELL DATA

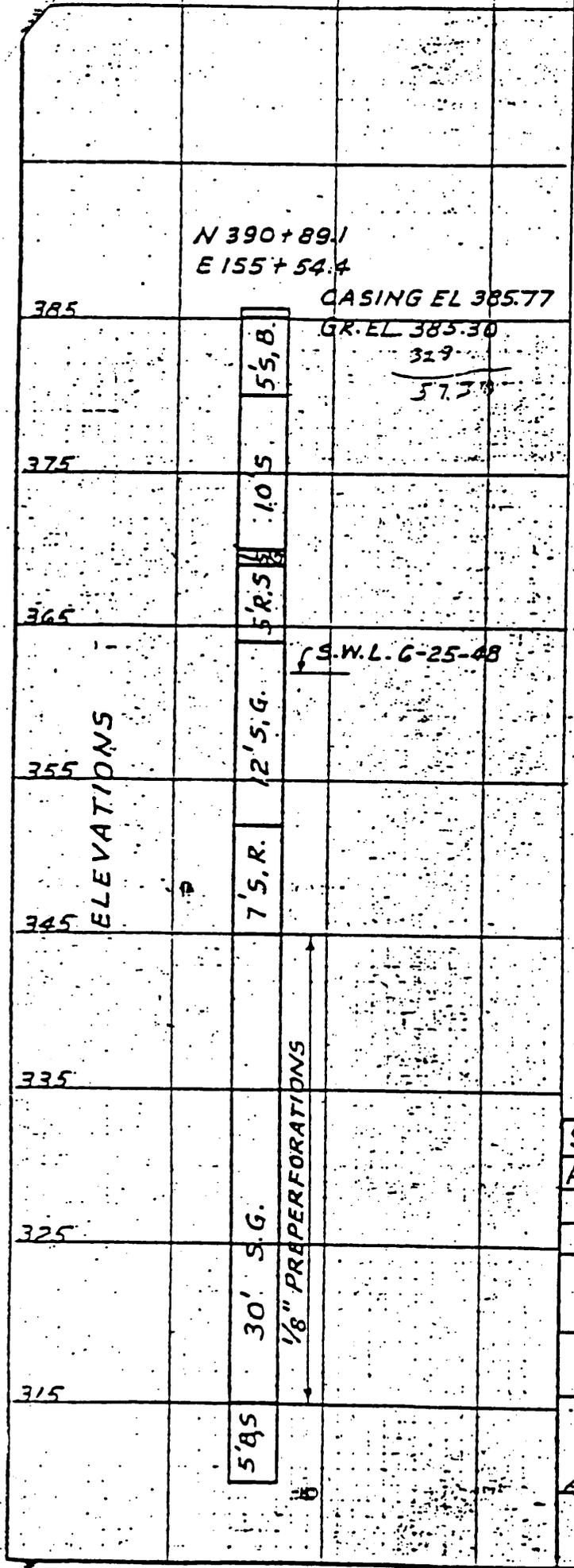
20" steel casing, pre-perforated from Elev. 315 to 345. Static water level after surging and before pumping Elev. 362. Sandfree in 10 minutes at first pumping. Pumped at 1000-2000 GPM for 12 hours. Drawdown 3 to 6 ft. Specific capacity 327 to 350. 1,000 GPM 6 stage Pomona pump, 250 ft. head, set at Elev. 328.

KEY

- B Boulders
- C Clay
- G Gravel
- R Rocks
- S Sand

Pomona Turbine
Serial # P.J 3053

Model Well # 4 North Highland



SCALE: 1"=10'
 APPROVED _____ DATE 8-20-48 DRAWN BY Quinn
 CHECKED BY Quinn

GENERAL ELECTRIC CO.
 HANFORD WORKS
 ALVORD, BURDICK & HOWSON
 CONSULTING ENGINEERS CHICAGO

LOG OF WELL-3000-D
 Abandoned 3/2/57 - New Well Complete 2/7/58
 DWG. NO. H-11-4123

3000 - D-5

~~3000 AREA DURAND #5 WELL~~

Started Drilling - 9-22-44
Finished Drilling - 10-13-44

Elev. Top of Pipe - 407.63
Ground Elevation - 407.50

Drilled by: Dishman & Morkert

Coordinates: N.415 / 72.19
E.161 / 80.37

12" Casing at 131'

Formation Record

0	2	2	Sand
2	6	4	Gravel and Boulders
6	16	10	Coarse Gravel
16	26	10	Medium Gravel
26	32	6	Coarse Gravel and Sand
32	40	8	Medium Gravel and some Sand
40	78	38	Coarse Gravel and some Sand
78	80	2	Medium Gravel and Sand
80	83	3	Boulders
83	94	11	Coarse Gravel and some Sand
94	98	4	Fine Sand and Medium Gravel
98	112	14	Coarse Gravel and Boulders
112	120	8	Medium Gravel and some Sand
120	124	4	Coarse Gravel and some Sand
124	128	4	Boulders and some Sand
128	134	6	Blue sandy Shale

Model Well # 5 North Richland

Cement plug set at
130.8'

Static - 10/13/44

Elevation 276.83

52' Elevation 355.50

Perforated 11-6-44
8 Vertical Holes
Spaced at 12" Centers
From 55' to 125'

Tested 11-21-44

1125 G.P.M. with 4.55 drawdown
Specific Capacity - 250
Tested for 16 hrs.

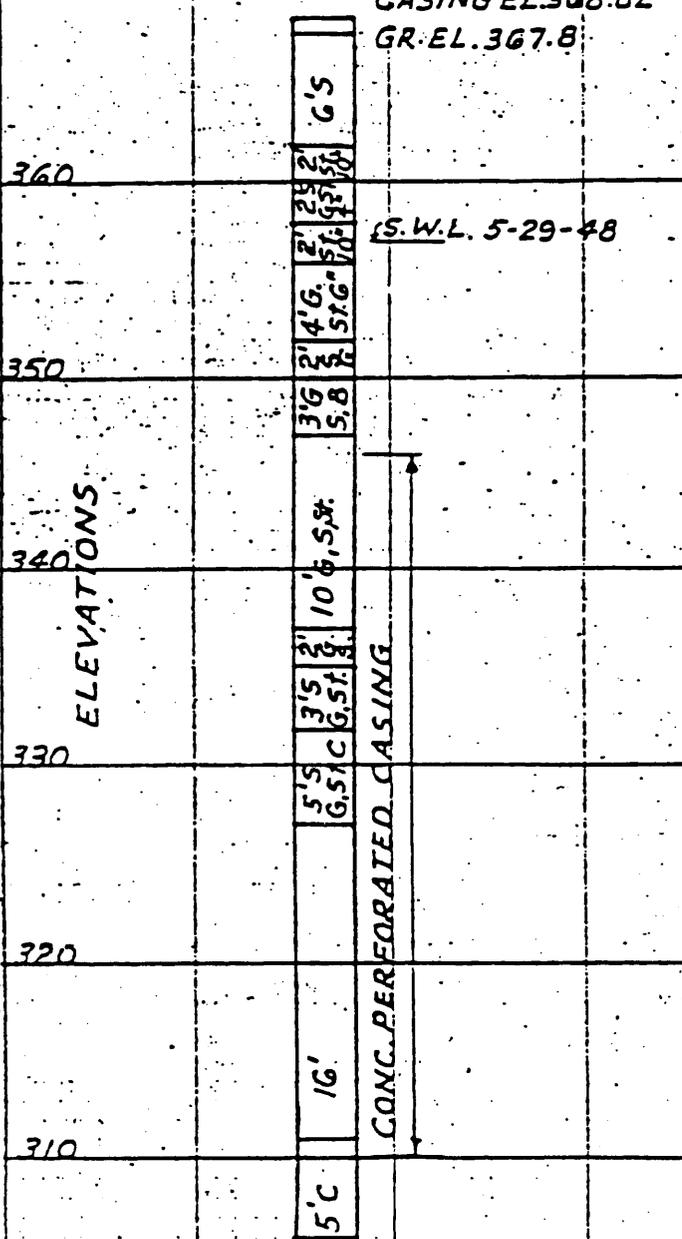
Equipped with a Pomona 1000 gpm pump driven
by a 75 H.P. Electric Motor, Serial = P.J. 3050

WELL DATA

Kelly Well - 17" I.D. concrete casing, gravel packed. Top 20' - 46", bottom 34". Concrete perforated casing Elev. 310 to 346. Station water level Elev. 357. Sandfree from beginning. 18 hours pumping at 1,385 GPM. Drawdown 2'4". Specific capacity 455. 2,000 GPM. Peerless pump 190 ft. head, set at Elev. 315.

N 388+31.1
E 159+04.1

CASING EL. 368.82
GR. EL. 367.8



ELEVATIONS

KEY

- B Boulders
- C Clay
- FS Fine sand
- G Gravel
- S Sand
- ST Stone

Model Well # 6 North Richland

SCALE: 1"=10'
APPROVED DATE 8-20-48 DRAWN BY Curt
CHECKED BY Curt

GENERAL ELECTRIC CO.
HANFORD WORKS
ALVORD, BURDICK & HOWSON
CONSULTING ENGINEERS CHICAGO

LOG OF WELL 3000-E

DWG. NO. H-11-4124

R. J. Strasser Drilling Co.

8110 S. E. SUNSET LANE
PORTLAND 8, OREGON

Information concerning wells 3000 J, 3000 L, 3000M

Log of Formations; 3000 L Model # 9 North Richland

<u>From</u>	<u>To</u>	<u>Formation</u>
Surface	5	Gravel and sand
5	27	Gravel, boulders and sand
27	39	Gravel and sand
39	42	Coarse sand
42	54	Gravel, boulders, and sand, Hit water @ 50'
54	68	Gravel and sand (water bearing)
68	71	Sand, gravel, and boulders, tight clay binder
71	83	Sand and gravel, clay binder, After a depth of 68', sand pumping lowered elevation of water in hole. Open hole without caving was permiss- ible due to tight clay binder in hole.

CASING: 3000L-Well cased to 83 ft. with $\frac{1}{2}$ " wall 20" O.D. pipe.
Casing perforated from 56' to 81'.

WELL 3000 M: H

LOG OF FORMATIONS: 3000M Model # 7 North Richland

<u>From</u>	<u>To</u>	<u>Formation</u>
Surface	15	Brown sand
15	20	Cemented gravel
20	30	Loose sand and gravel, large boulders
30	39	Loose gravel and sand, water bearing
39	51	Gravel and sand, formation tighter but water bearing
51	55	Fine runny brown sand

CASING: 3000 M-Well cased to 55 ft. with $\frac{1}{2}$ " wall 20" O.D. pipe
Casing perforated from 28' to 50'.

Well 3000 J: Log of formation from 52 to 69'

Model # 8 North
Richland

From 50 ft. to 62 ft.	Gravel, boulder, and sand
62 ft. to 69 ft.	sand and gravel
69 ft. to 71 ft.	gravel, sand and clay binder

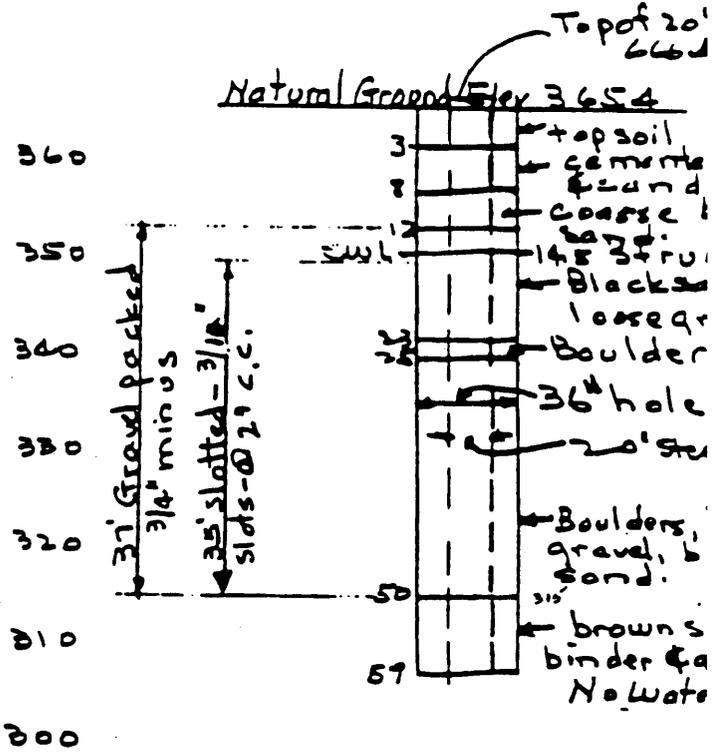
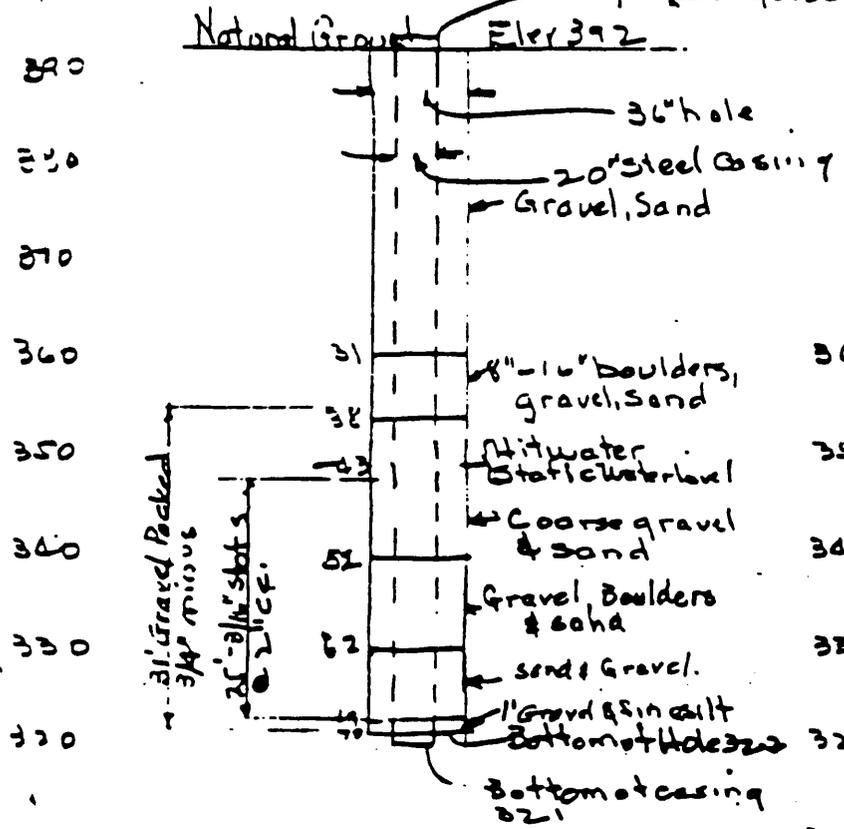
auth

Model # 8 North Richland

Well 3000 J

Well 3000 K

Model # 9 North Richland



Test pumped - 1800 gpm - 18' d.d.
Spec Cap 100

Test pumped - 2000 gpm, 25' d.d.
Pump to be set with bottom of bowl
@ -53' - 2000 gpm TDH + 2

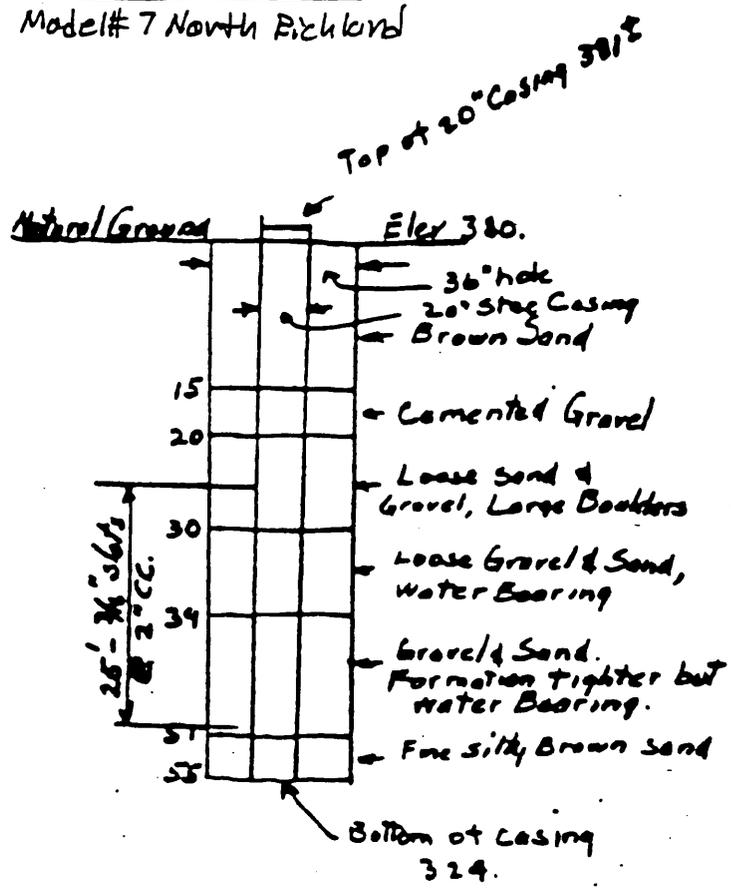
Pump to be set with bottom
of bowls @ 68' - 1400 gpm
TDH 230'

Completed with installation of pump 11-10

(Base of pump to
bottom of bowl
Well D. 72')

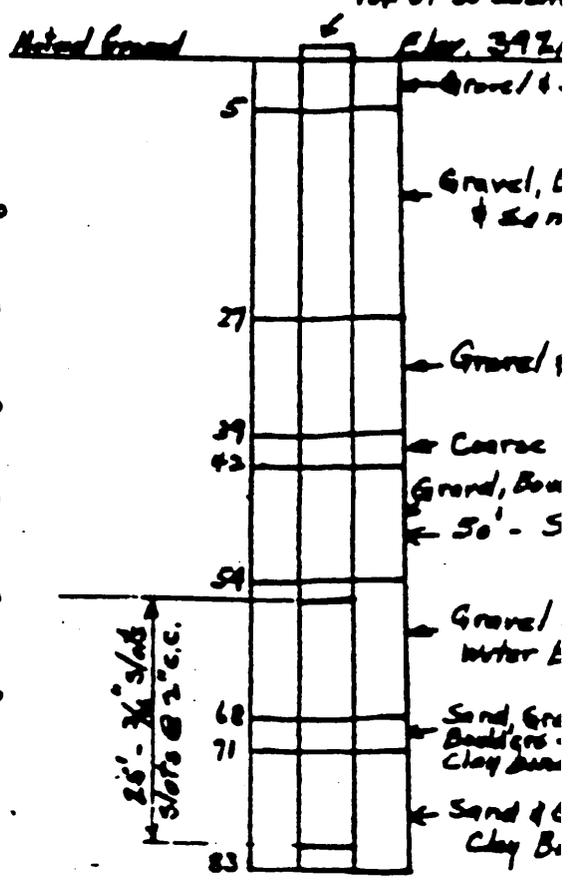
WELL 3000-H
Model # 7 North Richland

390
380
370
360
350
340
330
320
310



Model # 10 North Richland
WELL 3000-L
Top of 20" casing

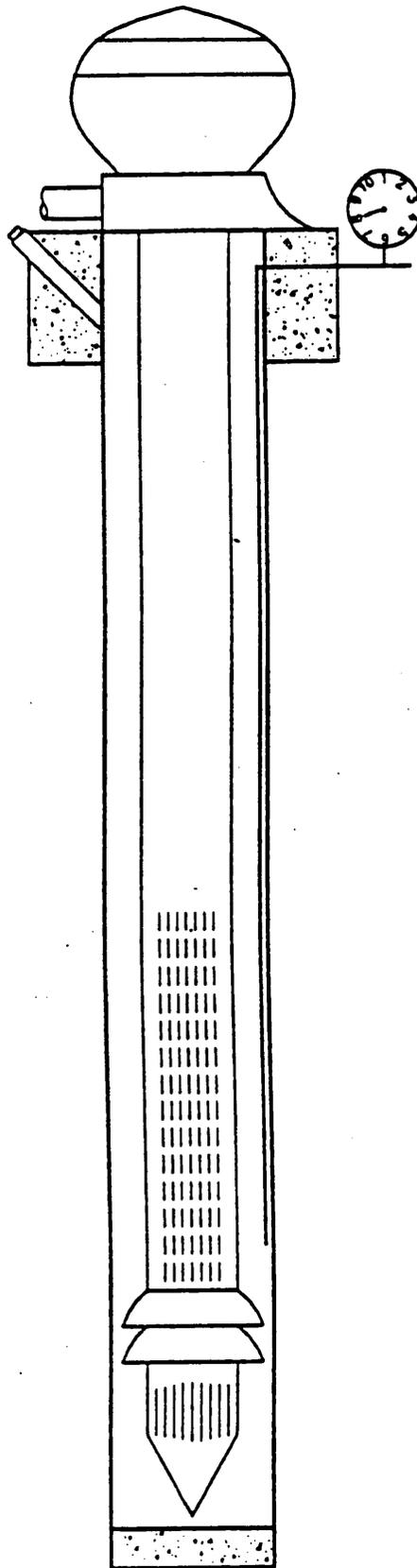
400
390
380
370
360
350
340
330
320
310



Test pumped 2000 gpm, 15' DD.
Spec Cap. 133.

Pump to be set with bottom of Bowls
@ 52' - 2000 gpm TDH 230'

GRADE ELEVATION 367.75'		
Sand & 14' Large Gravel		353.75'
Sand, 28' Gravel & Clay		325.75
14' Sand & Gravel		311.75
Sand, 9' Gravel & Clay		302.75
13' Sand & Gravel		289.75
Sandy Clay & Gravel	8'	281.75



Model well # 11 Duke



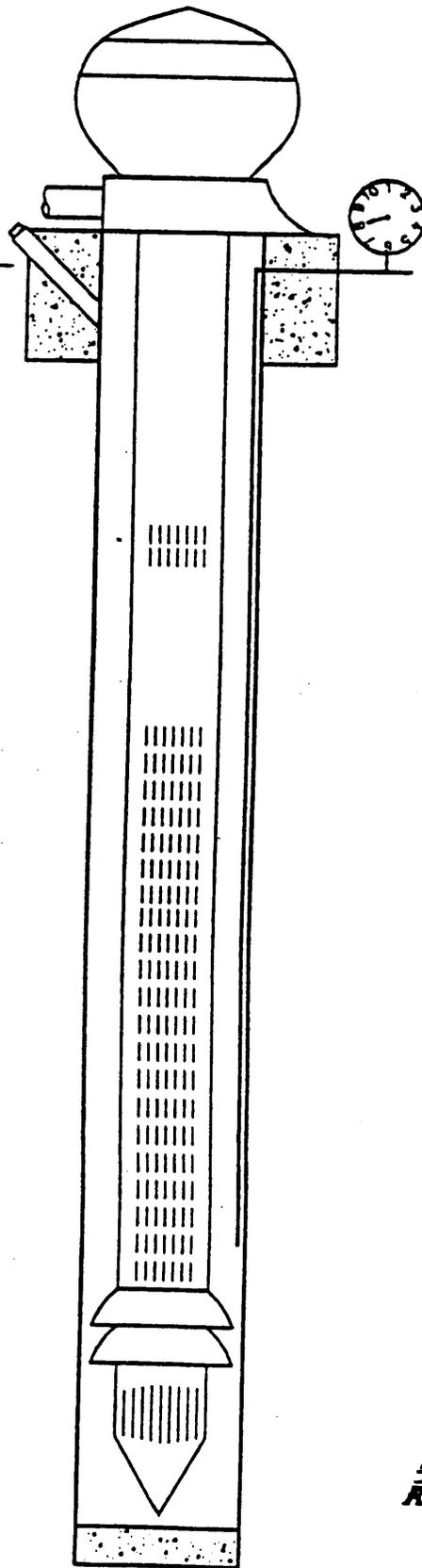
WELL 1100-D
DUKE FIELD (WEST)

WATER & WASTE UTILITIES

Drawn By: Ed Bridges	Date: 2/24/93
Approved By:	Scale: N.T.S.
Cadd File: W1100-D	Page:

GRADE ELEVATION 369.00'

18'	TOP SOIL	351.00'
6'	Coarse Gravel, some sand (cemented) Coarse washed gravel top of water strata. Static 12'9" Water shut off @ 25'6"	345.00'
3'	Coarse Gravel, Some Sand	342.00'
9'	Coarse Gravel, Some Sand and Clay	333.00'
2'	Gravel, Some Sand	331.00'
6'	Gravel, Sand & Clay	325.00'
22'	Loose Gravel (Static Water Level 19')	303.00'
34'	Sand, Gravel, Some Clay	269.00'
19'	Sand, Gravel, Some Clay (Open Hole)	250.00'
1'	Blue Clay	249.00'



Model
Well # 12 Duke



WELL 1100-8
DUKE FIELD (EAST)

WATER & WASTE UTILITIES

Drawn By: Ed Bridges	Date: 2/24/93
Approved By:	Scale: N.T.S.
Cadd File: W1100-8	Page:

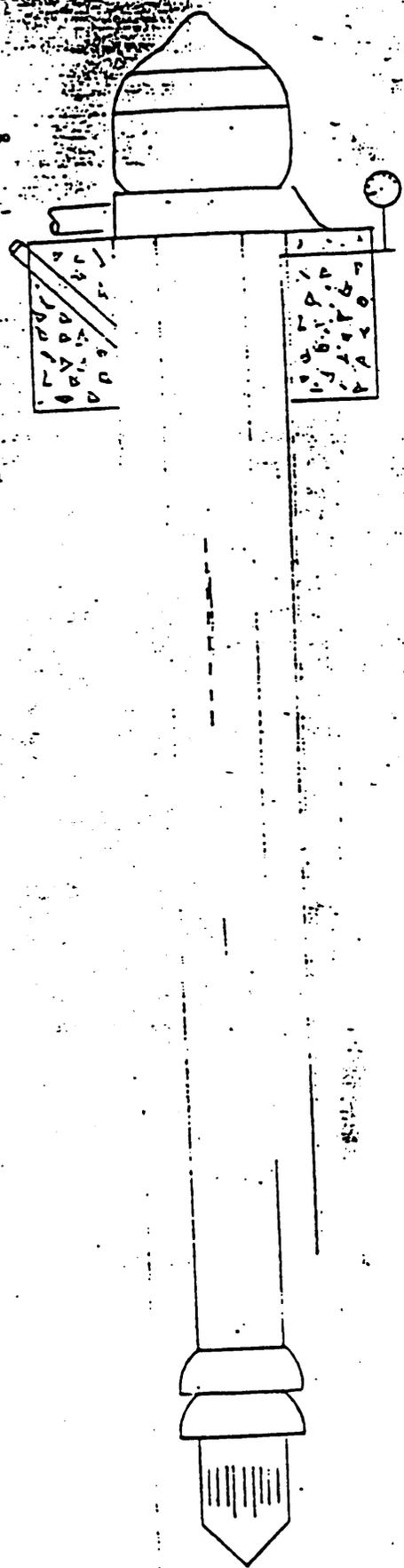
Reported Drilling 9/23/43
 Continued Drilling 10/23/43

WAY #5

Contractors A.S. Deard & Son, Valle Verde, Wash
 Drillers Erikh Adams
 Mayor Barwell

Drilling 1800 G.P.M.

Reference Elevation of measuring point compensating for angular displacement of the pipe which prevents entry into well casing is - 379.94
 1 1/2" pipe set at approximately 1 1/2" angle and welded into 18" casing with cap on end. This is to measure depth of water, with tape. Elevation top of 1 1/2" pipe - 379.90
 Grade Elevation - 340.00



State 11/20/43 35341

Fill	
Sand	
18"	342.00'
Silt and Clay	
10"	332.00'
Sand and Gravel	
4'	328.00'
Coarse Gravel	
2'	326.00'
Sand	
7'	313.00'
Coarse Sand and Gravel	
4'	311.00'
Fill Sand and Coarse Gravel	
16'	293.00'
Gravel and Sandstone	
9'	290.00'
Clay	
2'	288.00'

Water Temperature 37° F.

Performance Curve No. E.P.C. 1204
 2-1/2" Motor, 60 H.P., 440 Volt, 3 phase, 60 cycle
 Vertical hollow shaft, universal cage impeller, motor, open type with drip proof rain shield for outdoor service
 Type GPM, 1800 RPM, Serial / J32841

Lakehurst AP Altitudo Corp. This gauge shows the head of water above the bottom of air line. This head is measured in feet of water.
 -60 ft. 1/2" galvanized air line - 320.00
 Elevation bottom of air line - 340.00
 Elevation of water base - 340.00

Grade Elevation - 340.00

All pumping equipment housed in reinforced concrete pump house, 24' long, 12' wide.
 Elevation of floor - 339.5
 18" x 18" ceiling
 For details see Drawing E-4021 and E-4022

Motor J3945 Johnson right-angle gear drive.
 1750 RPM, Amp. 44 H.P.
 Serial No. 8136
 Complete with thrust bearing suitable for carrying gear thrust load of 4000# and including non-reverse clutch including V.S. J78 Water Motor flexible shaft 30" dia with 2 standard flanges hard and boy mount.

Workings vertical deep well pump with shaft drive at 2 stage bowl assembly, complete with cast iron pump head, having discharge connection, expansion flange 1 1/2" Style 14-22, Type G-2
 Head and drilled 1 1/2" American Standard cast iron bowl, bronze fitted, bronze impeller, stainless steel pump shaft, black steel column, steel shafting, water lubricated bearings, with non-reversing patent
 Total length of bowl - 3'6-1/4"
 G.S. of bowl - 15"
 Serial No. of Pump T-4149 - H.A. No. / 49-271
 Capacity of pump - 1500 GPM, with total dynamic head of 125 ft. operating at 1750 RPM

Performance curve # 2 on 1208
 Pump was designed to have a flat curve with non-overlapping characteristics and with shut-off head at the highest point on the curve at 125 ft.

Spooling Discharge Water, Serial #2275,
 Motor #1212, Type 218, Casting # 1404
 Set in 10" standard pipe, rated 1500 GPM
 There is an impeller in pipe connected to a gearing mechanism which is similar to the recorder, working on the same principle as a speedometer.

10" ID Michberg column located as follows:
 1 - 12" piece into head
 3 - 12" pieces into that
 1 - 9'-3/4" piece into that
 1 - 2'10-3/4" bowl assembly below that
 1 - 3 1/2" strainer at the bottom
 Total length of column from top of base plate to top strainer - 66'
 Column pipe is 10" standard ID Lapweld Steel Pipe with threaded coupling
 Wall thickness - 0.37

1 Head Shaft 3 1/2" 1000 ground and polished steel, 3'2-3/4" long, diameter 1 1/2"
 1 Gear Shaft 1'7/8" long
 Flange setting below pump base - 2 1/2" long
 5 - 12" pieces below that
 1 - 9'-3/4" piece below that
 1 - 3'-1/4" piece below that
 Total length of shaft - 63'5"

Description of construction of well
 18" OD casing, wall thickness 3/8", set at 77' int
 Perforated in 8 vertical rows of 2" x 1/2" slots, on 6" centers from 16' to 48' or from elevation 27 3/4.00 - total perforated 22'
 Drilled with cable tools.

L-Continental Motor with Teis Disc, power take-off 60 H.P., 1800 RPM, 3 phase, 440 volt
 Vertical hollow shaft, universal cage impeller, motor, open type with drip proof rain shield for outdoor service and non-reversing clutch
 Serial / J32841

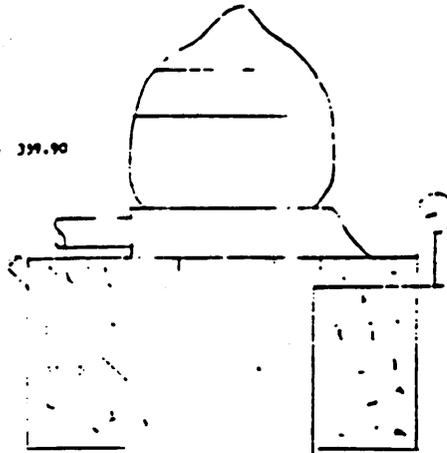
Elevation bottom of lowest bowl - 294.00
 Elevation of uppermost opening of strainer - 295.50
 10" Green Strainer 3 1/2" long
 Elevation of concrete plug - 290.71
 Elevation bottom of steel joint - 284.00

Drawn and Material supplied by Clayton E. B. Water Well Co.
 as per instructions of V. J. Adams

Contractor: A. A. Burdick & Son, Mills Mills, Wash.
Drillers: Forest Jones

Reference Elevation of measuring point corresponding for angular displacement of the pipe which permits entry into well casing is - 399.79
1 1/2" pipe cut at approximately 4 3/4" angle and welded into 1 1/2" casing with tap on end. This is to measure depth of water, with tape. Elevation top of 1 1/2" pipe - 399.00

Grade Elevation - 395.00



Well	
Bore 9 7/8" dia elevation 345.00	
14'	379.00'
Sand and Silt	
4'	375.00'
Dark Sandy Silt	
5'	370.00'
Sand and Silt	
5'	365.00'
Coarse Sand and Gravel	
3'	362.00'
Medium Gravel	
2'	360.00'
Coarse Gravel	
13'	307.00'
Sand and Gravel	
3'	304.00'
Sandstone and Gravel	
5'	299.00'
Gravel and Brown Sand	
5'	294.00'
Red Clay	
6'	288.00'

Purchase Order No. E.F.C.
L-4-L. Motor, 50 H.P., 220/440 Volt, 3 phase, 60 c
Vertical boiler shaft, vertical case induction, in
open type with slip proof pole shield for outside
service
Type CFT, 1200 RPM, Serial #77048)

1-1/2" x 1/2" All-Union Case. This gear shows
the head of motor above the bottom of air line.
head is depressed in foot of water.
35 ft. 1/2" galvanized air line.
Elevation of bottom of air line - 309.00
Elevation of motor base - 360.00

Ground Elevation - 395.00

All pumping equipment housed in reinforced concrete
pump house, 23 1/2' long, 12' wide
Elevation of floor - 397.5
With 4' collar
For details see Drawing 2-4-41 and 2-4-42

Vertical deep well pump with dual drive
2 stage bowl assembly, complete with cast iron pump
head, having discharge connection, ammonia flow
Style 12-100, Type 120-2
Paced and drilled 12 1/2" American Standard cast iron
bowl, bronze fitted, bronze impellers, stainless
steel pump shaft, black steel column, steel shaft
water lubricated bearings, with non-revolving rate
Total length of bowl - 3 1/2"
OD of bowl - 11 1/2"
Serial No. of Pump 7-4447 - U.S. 12 /
Capacity of pump - 1000 GPM, with total dynamic h.
of 125 ft. operating at 1750 RPM

Performance curve # 2 on 1242
Pump was designed to have a flat curve with non-
overloading characteristics and with constant head
at the highest point on the curve at 125 ft.

Spurling Recording Motor, Serial #12460
Motor #2517 Type 218, Cutting # 1 1/2"
Set in 10" standard pipe, range 1500 GPM
There is an impeller in pipe connected to a
gearing mechanism which is coupled to the recorder,
working on the same principle as a speedometer.

8" ID Discharge column located as follows:
1 - 12" piece into head
4 - 10" piece into that
1 - 7 1/2" piece into that
1 - 3 1/2" bowl assembly below that
1 - 3 1/2" strainer at the bottom
Total length of column from top of base plate to
strainer - 3 1/2"
Column pipe is 8" standard ID Lapweld Steel Pipe of
threaded coupling
Wall thickness - 0.25

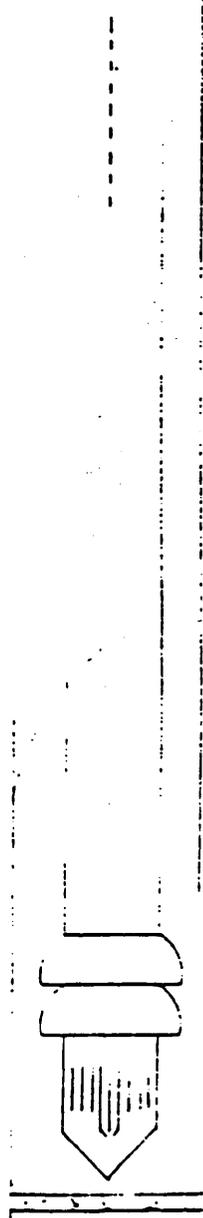
1 Head Shaft 3 1/2" 1000 ground and polished steel,
2 1/2" x 1/4" long, diameter 1-1/2"
Flange setting below pump base - 2 1/2" long
4 - 10" piece below that
1 - 7 1/2" piece below that
1 - 4 1/2" piece below that in bowl assembly
Total length of shaft - from bottom of pump base to
of bowl - 17' 6"

Description of construction of well
33' of 36" diameter pipe cover removed
62' of 21" casing joined back
11" casing cut at 67' below grade into clay
After 11" was inserted gravel was placed between 11"
and 21" - the 21" was pulled out as gravel was set
34 yds. of 1 1/2" gravel used
Preperforated pipe put in 8 1/2" dia from 21" to 60"
Slots 3/4" x 5" staggered with a total of 1127 slots
Drilled with cable tools

Elevation of bottom of lower bowl - 308.00
Elevation of uppermost opening of
strainer - 307.80
8" Green Strainer 3 1/2" long
Elevation of concrete plug - 289.00
Elevation of bottom of steel joint - 288.00

Drawn and Material compiled by: Captain E. E.
Water Well Co.

as per instructions of
E. J. Stone



WATER WELL REPORT
STATE OF WASHINGTON

Application No. 64-25960

Permit No. 64-25960 P

(1) OWNER: Name The Quadrant Corporation Address P.O. Box 130, Bellevue, WA 98009

(2) LOCATION OF WELL: County Benton SE 1/4 SW 1/4 Sec 36 T 9 N. 28E W.M.
Bearing and distance from section or subdivision corner 230' 529° 57' 32" of NE corner of SE 1/4 SW 1/4 S 36

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

(4) TYPE OF WORK: Owner's number of well (if more than one) 1
New well Method: Dug Bored
Deepened Cable Driven
Reconditioned Rotary Jetted

(5) DIMENSIONS: Diameter of well 14" x 12 1/2" inches.
Drilled 1208 ft. Depth of completed well 1208 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 22 - Diam. from 0 ft. to 90 ft.
Threaded 14 - Diam. from 0 ft. to 940 ft.
Welded - 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 _____ Model No. _____
Type _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

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

Surface seal: Yes No To what depth? 90 ft.
Material used in seal best cement
Did any strata contain unusable water? Yes No
Type of water? _____ Depth of strata _____
Method of sealing strata _____

(7) PUMP: Manufacturer's Name NONE
Type: _____ HP _____

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 89 ft. below top of well Date 1-16-79
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 layne
Was a pump test made? Yes No If yes, by whom? layne

Yield: 600 gal/min with 104 ft. drawdown after 2 hrs.
" 800 " " 174 " " 4 "
" 1000 " " 277 " " 6 "
" 1200 " " 367 " " 8 "

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 1-16-79
Ballot test _____ gal/min with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m. Day _____
Temperature of water 83 F Was a chemical analysis made? Yes No

(10) WELL LOG:

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 formation.

MATERIAL	FROM	TO
Fine sand small gravel	0	25
Medium & coarse gravel	25	38
Coarse gravel to 1/2"	38	68
Large rocks 4" or better	68	85
Gray & black hard basalt	85	93
Gray hard basalt	93	170
Blue silt with a yellow clay streak, soft	170	178
Blue clay	178	199
Fractured black basalt with blue clay interbeds	199	212
Gray & black basalt, some water, medium hard	212	235
Black medium hard basalt	235	250
Black medium hard basalt fractured	250	259
Gray hard basalt	259	336
Gray fracture basalt	336	345
Black silty clay some dominant blue included	345	359
Black medium hard basalt	359	368
Gray medium fractured basalt	368	379
Black basalt clay, soft	379	385
Gray medium hard basalt	385	398
Gray hard basalt	398	432
Gray & black basalt, small amount of gray clay, soft	432	439
Black & gray hard basalt	439	480
Black hard basalt	480	558
Black hard basalt, sandstone	558	588
Black fractured medium basalt	588	619
Gray fractured very rough hard basalt	619	672
Clay, gray basalt, gray chine, silt	672	672
Black hard basalt	672	728

-Continue on following page-
Work started 12-10-78 Completed 1-16-79

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Layne - Western Company, Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 336, Moses Lake, WA 98957

[Signed] [Signature]
(Well Driller)

License No. 0733 Date 1-16-79

WATER WELL REPORT

STATE OF WASHINGTON

Application No. 64-25960

Permit No. 64-25960 P

(1) OWNER: Name The Quadrant Corporation Address P. O. Box 130, Bellevue, WA 98008

(2) LOCATION OF WELL: County Benton SE 1/4 SW 1/4 Sec 36 T. 9 N. R. 28E W. 4
Bearing and distance from section or subdivision corner 230° 52' 57" 32" of NE corner of SE 1/4, SW 1/4, S 36

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

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

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

(6) CONSTRUCTION DETAILS:
Casing installed: _____ O.S.A. from _____ ft. to _____ ft.
Threaded _____ I.O.S.A. from _____ ft. to _____ ft.
Welded _____ E.I.S.A. 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 _____ Model No. _____
Type _____
Diam. _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

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

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

(7) PUMP: Manufacturer's Name _____
Type _____ H.P. _____

(8) WATER LEVELS: Land-surface elevation above mean sea level..... ft.
Static level _____ ft. below top of well Date _____
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? _____
Yield: _____ gal./min. with _____ ft. drawdown after _____ 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 _____
Boiler test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes No

(10) WELL LOG:

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 formation.

MATERIAL	FROM	TO
-Continued from previous page-		
Black medium hard basalt	728	732
Gray hard basalt	732	748
Fine gravel, siltstone, hard	748	770
Clay, gray basalt, black chips	770	783
Green clay	783	807
Black basalt, medium soft basalt	807	821
Gray clay, clay mixed with mud	821	833
Black fine grained, medium hard siltstone	833	854
Gray clay streaked with soft bed of basalt	854	924
Clay, sand	924	934
Basalt, highly vesicular	934	967
Fractured, water bearing	967	986
Black & gray basalt, water bearing	986	1075
Black basalt	1075	1125
Siltstone	1125	1128
Gray basalt, water bearing	1128	1195
Green siltstone, water bearing	1195	1208

Work started 12-10-76 Completed 1-16-77

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Layne - Western Company, Inc.
(Person, firm, or corporation) (Type or print)

Address P.O. Box 336; Moses Lake, Wa 98837

(Signed) [Signature]
(Well Driller)

License No. 0733 Date 1-16-77 19__

APPENDIX B
ANALYTICAL MODEL SUMMARY

TWODAN version 3.0 text output file

Filename: rich.out

Date this file was written by TWODAN: 11/27/94

Time this file was written by TWODAN: 15:17:43

Aquifer input data:

Base elevation: 215.000

Hydraulic conductivity of lower layer : 295.000

Thickness of lower layer: 150.000

Hydraulic conductivity of upper layer : 295.000

Thickness of upper layer: 25.0000

Uniform crossflow data:

Uniform aquifer discharge rate: 0.500000E-01

Angle of uniform flow direction from x axis: 8.00000

Circular areas of local recharge:

Column 1: Circular recharge area number

Column 2: Incremental recharge rate within circle

Column 3: x coordinate of circle center

Column 4: y coordinate of circle center

Column 5: Radius of circle

1	3.80000	0.194997E+07	365645.	213.517
2	3.80000	0.194988E+07	365219.	216.609
3	3.80000	0.194965E+07	364630.	135.829
4	3.80000	0.194966E+07	364377.	114.664
5	3.80000	0.194961E+07	364887.	117.850

Reference head input data:

Specified head: 353.000

x coordinate of reference point: 0.194295E+07

Y coordinate of reference point: 373745.

Well input data (steady-state wells):

Total number of steady wells: 13

Discharge-specified wells:

Column 1: well number

Column 2: x coordinate of well

Column 3: y coordinate of well

Column 4: discharge of well

1	0.194962E+07	365986.	66000.0
2	0.195016E+07	366026.	66000.0
3	0.195018E+07	365203.	65000.0
4	0.194977E+07	364999.	66000.0
5	0.195036E+07	367473.	66000.0
6	0.195010E+07	364730.	65000.0
7	0.195023E+07	365584.	65000.0
8	0.194965E+07	365312.	66000.0
9	0.195005E+07	364345.	65000.0
10	0.194984E+07	364725.	66000.0
11	0.194906E+07	359556.	173000.
12	0.194897E+07	359578.	173000.
13	0.195244E+07	358530.	80000.0

Linesink input data:

Total number of linesinks: 5

Head-specified linesinks:

Column 1: linesink number

Column 2: x1 coordinate of linesink

Column 3: y1 coordinate of linesink

Column 4: x2 coordinate of linesink

Column 5: y2 coordinate of linesink

Column 6: discharge/length of linesink

Column 7: total discharge of linesink

Column 8: head specified at center of linesink

1	0.195193E+07	373175.	0.195255E+07	369619.	133.304	481137.	344.000
2	0.195255E+07	369619.	0.195321E+07	365636.	54.3856	219611.	343.000
3	0.195321E+07	365636.	0.195393E+07	361605.	64.5674	264260.	342.000
4	0.195393E+07	361605.	0.195298E+07	357243.	56.2726	251219.	341.000
5	0.195298E+07	357243.	0.195212E+07	353213.	180.826	744980.	340.000

The following sections check if the solution met specified boundary conditions

Reference point boundary condition:

Specified head at reference point: 353.000

Model-calculated head at reference point: 353.026

Head-specified linesink boundary conditions:

Column 1: linesink number

Column 2: head specified at center of linesink

Column 3: model-calculated head at center of linesink

1	344.000	344.069
2	343.000	343.098
3	342.000	341.972
4	341.000	340.942
5	340.000	339.955

TWODAN version 3.0 text output file

Filename: RICHPUMP.TXT

Date this file was written by TWODAN: 08/18/95

Time this file was written by TWODAN: 14:47:34

Aquifer input data:

Base elevation: 215.000

Hydraulic conductivity of lower layer : 295.000

Thickness of lower layer: 150.000

Hydraulic conductivity of upper layer : 295.000

Thickness of upper layer: 25.0000

Uniform crossflow data:

Uniform aquifer discharge rate: 0.500000E-01

Angle of uniform flow direction from x axis: 8.00000

Circular areas of local recharge:

Column 1: Circular recharge area number

Column 2: Incremental recharge rate within circle

Column 3: x coordinate of circle center

Column 4: y coordinate of circle center

Column 5: Radius of circle

1	3.80000	0.194997E+07	365645.	213.517
2	3.80000	0.194988E+07	365219.	216.609
3	3.80000	0.194965E+07	364630.	135.829
4	3.80000	0.194966E+07	364377.	114.664
5	3.80000	0.194961E+07	364887.	117.850

Reference head input data:

Specified head: 353.000

x coordinate of reference point: 0.194295E+07

Y coordinate of reference point: 373745.

Well input data (steady-state wells):

Total number of steady wells: 13

Discharge-specified wells:

Column 1: well number

Column 2: x coordinate of well

Column 3: y coordinate of well

Column 4: discharge of well

1	0.194962E+07	365986.	66000.0
2	0.195016E+07	366026.	66000.0
3	0.195018E+07	365203.	65000.0
4	0.194977E+07	364999.	66000.0
5	0.195036E+07	367473.	66000.0
6	0.195010E+07	364730.	65000.0
7	0.195023E+07	365584.	65000.0
8	0.194965E+07	365312.	66000.0
9	0.195005E+07	364345.	65000.0
10	0.194984E+07	364725.	66000.0
11	0.194906E+07	359556.	173000.
12	0.194897E+07	359578.	173000.
13	0.195244E+07	358530.	80000.0

Linesink input data:

Total number of linesinks: 5

Head-specified linesinks:

Column 1: linesink number

Column 2: x1 coordinate of linesink

Column 3: y1 coordinate of linesink

Column 4: x2 coordinate of linesink

Column 5: y2 coordinate of linesink

Column 6: discharge/length of linesink

Column 7: total discharge of linesink

Column 8: head specified at center of linesink

1	0.195193E+07	373175.	0.195255E+07	369619.	133.304	481137.
344.000						
2	0.195255E+07	369619.	0.195321E+07	365636.	54.3856	219611.
343.000						
3	0.195321E+07	365636.	0.195393E+07	361605.	64.5674	264260.
342.000						
4	0.195393E+07	361605.	0.195298E+07	357243.	56.2726	251219.
341.000						
5	0.195298E+07	357243.	0.195212E+07	353213.	180.826	744980.
340.000						

The following sections check if the solution met specified boundary conditions. If transient wells are present, the time used by the transient well functions for the boundary condition check is: 0.000000

Reference point boundary condition:

Specified head at reference point: 353.000

Model-calculated head at reference point: 353.026

Head-specified linesink boundary conditions:

Column 1: linesink number

Column 2: head specified at center of linesink

Column 3: model-calculated head at center of linesink

1	344.000	344.069
2	343.000	343.098
3	342.000	341.972
4	341.000	340.942
5	340.000	339.955

APPENDIX C
POTENTIAL CONTAMINANT SOURCES

**CITY OF RICHLAND
WELL HEAD PROTECTION PLAN
INVENTORY OF POTENTIAL CONTAMINATORS**

IOT Zone	BUSINESS NAME	NUMBER	BUSINESS ADDRESS STREET NAME	CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bus. Lic. CAT	R. Bus. Lic. SCO
>10	Recontek of Washington	2109	Battelle Blvd	RCRA Listed			-99	CLOSED	
>10	Pringles, Inc.	1508	Symons St	S			-99	F05	210
>10	Bedger Hill Remote Radio (4430-B01)	Lt:46	14 02/LG:119 19 05/3 MI SW RC	UST			-99		
>10	Penwest Foods Company	216	1st St	L			-99		
>10	Stevens Blvd		Battelle Blvd	Injection Well			-99		
>10	Hoxie Ave		Catkill St	Injection Well			-99		
>10	Forest Ave		Dogwood	Injection Well			-99		
>10	Supply System Corp Headquarters	3000	Georgia Washington Way	UST			-99		
>10	WDOE CRO Verrata Best Areas	MP 43 Northbound	Hwy 24	RCRA Listed			-99		
6	Federal Building US Post Office/USGSA	826	Jedwin Ave	UST			-99		
6	City of Richland Energy SVC Dept/WWTWP	565	Leacy	UST			-99		
6	New Richland Central Office (4581-B01)	762	Manfield St	UST			-99		
6	Richland Central Office (4580-B01)	761	Manfield St	UST			-99		
10	Harris Ave		Newcomer/Willis	Injection Well			-99		
>10	Herrick Ave		Newcomer/Willis	Injection Well			-99		
>10	Oualwood		Palmer Ct	Injection Well			-99		
>10	Benton County Fire District #4	Box 6980	Route 1	UST			-99		
>10	City of Richland	1997	Saint St	RCRA Listed			-99		
>10	US Ecology, Inc.	PO Box 638	Sec 9 INSP 12N R26EWM	UST			-99		
>10	Richland SD 400 Admin Off	615	Stow Ave	RCRA Listed			-99		
6	Stevens Dr		Snyder	Injection Well			-99		
>10	Washington State University Tri Ci	100	Spangler/Saint	Injection Well			-99		
>10	Richland Landfill		Sprout Rd	RCRA Listed			-99		
>10	WDOE CRO WDOI Columbia River Brg	MP 43.60	SR 240 & Growcup Rd	Injection Well			-99		
>10	North Richland Central Office (4490-B02)	2600	Stevens Dr (N. Richland)	RCRA Listed			-99		
10	City of Richland	506	Swift Blvd	UST			-99		
>10	Hanford Generating Project		T14N R28E SW 528 N of City	RCRA Listed			-99		
>10	Richland Airport	1901	Terminal Building Ramp	UST			-99		
>10	Richland Airport		Terminal Dr	UST			-99		
>10	Davison/Harris		Wallace St	Injection Well			-99		
10	Design Works, Inc.	2000	Walton Blvd	S			1		017
>10	Japanese Engines and Transmissions, Inc.	1900	Logston Blvd	RCRA Listed			2	C01	001
>10	Shuck's Auto Supply/Northern Automotive Corp	1440	Fowler St	M		M	2	C01	003
>10	Taylor Automotive Parts, Inc.	877	Jedwin Ave	M			2	C01	004
>10	AI's Auto Supply #334	1307	Stevens Dr	M			2	C01	005
>10	R&R Sales	1976	Jedwin Ave	M			2	C01	008
>10	Inland Northwest Distributing	911	Butler Loop Rd	M			2	C01	009
>10	B & M, Inc.	1382	Columbia Dr SE	S			2	C10	001
>10	Sun West, Inc.	266	Jedwin Ave	M			2	C10	004
>10	Sundown Marine/Auto, Inc.	1238	Wellian Way	M			2	C10	006
>10	Tim Bush Motor Company, Inc.	1402	Columbia Dr SE	M			2	C10	072
>10	Hi Tec Hobby's	284	Jedwin Ave	M			2	C14	089
>10	Bart's Auto Dan, Inc.	1327	Wellian Way	M			2	C14	091
>10	Car Port	1417	Columbia Center Blvd	M			2	C14	094
>10	Mary's Automotive Repair	100	Columbia Center Blvd	M			2	CLOSED	
>10	Victory Racing	76	Wellian Way	M			2	CLOSED	
>10	Maturing Sves, Inc.	419	Wellian Way	M			2	CLOSED	
>10	Transtate Asphalt Co.	63	Wellian Loop	RCRA Listed			2	CLOSED	
>10	B&B Enterprises - Welding	86	Wellian Way	M			2	F03	028
>10	Richland Motorcycle	616	Wellian Way	M			2	F06	139
>10	Perfection Tire	1113	Lee Blvd	M			2	F06	148
>10	Northwest Rental Center, Inc.	226	Wellian Way	S			2	F06	359
>10	U-Head Center of Richland	939	Columbia Dr SE	UST			2	F06	361
>10	Lorne Bangler Ford/Dodge, Inc.	1775	Fowler St	UST			2	F06	364
>10	Poyner's RVH Motor Supply, Inc.	843	Stevens Dr	M		M	2	F06	001
>10	Budget Car & Truck Rental	500	Wellian Way	S			2	F06	003
>10	Super Lube	421	Wellian Way	UST			2	F06	004
>10	Motoring Sves, Inc.	327	Wellian Way	RCRA Listed			2	F06	005
>10	Leas Line Up and Tires	961	Wallhouse Loop	RCRA Listed			2	F07	003
>10	Redline Motor Sports/European Auto	90_908	Columbia Dr SE	M			2	F07	004
>10	Cronk Automotive	2676	Wellian Way	M			2	F07	007
>10	Dean's Auto Repair	1621	Van Green St	M			2	F07	012
>10	Richland Auto Repair, Inc.	1415	Terminus Dr	RCRA Listed			2	F07	013
6	Tri City Towing	837	Gillespie St	M			2	F07	014
6	Lee Schwab Tire Center #3333	2243	Stevens Dr	S			2	F07	015
6	Pat Murphy Enterprises		Stevens Dr	M			2	F07	020

**CITY OF RICHLAND
WELL-HEAD PROTECTION PLAN
INVENTORY OF POTENTIAL CONTAMINATORS**

TO1 Zone	BUSINESS NAME	NUMBER	BUSINESS ADDRESS STREET NAME	CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bus. Lic. CAT	R. Bus. Lic. SEC
>10	Pat Murphy Enterprises	2676	Van Giesen St	M			2	F07	020
>10	McCue Repair & Towing	295	Williams Blvd	RCRA Listed	M		2	F07	022
>10	McGee's Dry Cleaning	6002	W Gage Rd				2	F07	025
>10	Meadow Springs Car Wash	107	W Gage Rd	M			2	F20	004
>10	Van Giesen Car Wash	311	Van Giesen St	M			2	F20	005
1	Hertz Car Sales	825	Goethals Dr	M			2	T01	002
>10	V and M Offroad Performance	113	Benham St	M			2		
>10	Ben Franklin Transit Richland	1000	Columbia Dr SE	UST	RCRA Listed		2		
>10	U-Head Center of Richland	939	Columbia Dr SE	S			2		
10	Richland Airport		Control Tower Ramp Area	UST			2		
6	Automotive Wholesalers Inc	601	George Washington Way	UST			2		
6	Top Auto, Inc. Richland	601	George Washington Way	RCRA Listed			2		
6	USA Holding Inc dba Tiramax	601	George Washington Way	UST			2		
6	Consolidated Wash	0-1004	Goethals Dr	UST			2		
5	R & R Emergency Road Service	95	Goethals Dr	S			2		
>10	Vacuum Recing Specialties	1851	Jedwin Ave	M			2		
>10	Richland High School Auto Repair S	930	Long Ave	RCRA Listed			2		
6	Equip Maint/ City of Richland	1300	Marshall St	UST	RCRA Listed		2		
10	Kedlec Medical Center Physical Plant	888	Swift Blvd	UST			2		
>10	Cooke Aviation	1901	Terminal Dr	M			2		
6	Maintenance Shop	714	Thayer Dr	UST			2		
1	WV Pate Sales	330	Walleian Way	M			2		
1	Atomic Auto Sales	292	Walleian Way	M			2		
1	Richland Auto Sales	32	Walleian Way	M			2		
1	Cascade Battery Warehouse	100	Walleian Way	M			3	CLOSED	008
6	Tri-Cities Battery, Inc.	601	George Washington Way	M			3	F07	007
>10	Richland Battery & Battery	190	Walleian Way	M			3	F07	019
>10	Standard Batteries	916	Columbia Dr SE	M			3		
1	Desert Air Sailboats & Equipment	500	Walleian Way	M			4	C14	004
>10	Hobie Cat Sport & Sail	1238	Columbia Dr SE	M			4		
>10	The Boat Shop Marina Inc	1778	Columbia Dr SE	UST			4		
>10	Hovercraft Unlimited		Columbia Pnt Pk	M			4		
>10	Richland Yacht Club	20	Merina Pnt Dr	UST			4		
10	A&B Marine Repair	1330	Nevada Avenue SE	M			4		
>10	Richland Marine	1621	Terminal Dr	M			4		
1	Copeland Lumber Yards, Inc.	1350	Aaron Dr	UST	S		4		
10	Richland Industrial	500A	Walleian Way	S			5	C07	007
>10	Color Tile	1226	Montana St	M			5	C13	004
>10	Chemcheck Instruments, Inc.	1846	Terminal Dr	S			5	C13	006
6	Huck 'n' Floor Covering, Inc.	703	The Parkway	S			5	C13	012
5	Standard Paint & Wallpaper, Inc.	797	Stevens Dr	S			5	C14	009
1	Craftman Floor Covering	122	Walleian Way	M			5	C14	115
>10	Benjamin's, Inc.	1324	Jedwin Ave	S			5	C14	188
1	Drywell Interiors	516	Warehouse St	S			5	F03	256
>10	B & R Hardware Floor, Inc.	1300	Columbia Center Blvd	S			5	F03	367
1	The Glass Works	108	Walleian Way	S			5	F03	440
1	Richland Glass	37	Walleian Way	S			5	F03	578
1	Richland Glass	974	Walleian Way	S			5	F03	693
>10	Rice's Carpetland	285	Williams Blvd	S			5	F03	717
>10	Delmax Upholstery	708	Symons St	S			5	F05	048
10	Stone's Carpet Installation	609	Newcomer St	S			5	F06	242
1	Richland Carpet	3243	Walleian Way	S			5		
1	Richland Carpet	3243	Walleian Way	S			5		
1	Richland Carpet	3243	Walleian Way	S			5		
6	Three Rivers Janitorial Supply	172	Laurelwood Ct	S			7	C14	101
10	Washington Industrial Supply	606	Boroe Ct	S			7	CLOSED	
>10	Chem-Add Services, Inc.	1616	Walleian Way	M			7	F18	005
1	Tri-City Cleaners	101	Columbia Dr SE	M			7		
>10	Century Services, Inc./Yo's Washy Washy	1411	Walleian Way	M			8	CLOSED	
>10	One Hour Cleaners	1823	Williams Blvd	M			8	F14	002
6	Richland Laundry & Dry Cleaning Inc/US Linen	1108	George Washington Way	UST			8	F14	003
>10	Interstate Nuclear Services	2424	Herding St	UST	M		8	F14	006
6	New City Cleaners Richland	747	Robertson Dr	M			8	F14	006
1	1313 Cleaning	1031	Stevens Dr	UST			8	F14	007
>10	The Great Soap Opera Dry Cleaners	1370	Walleian Way	UST	M		8	F18	008
>10	Reder Electric Co., Inc.	222	Jedwin Ave	S	RCRA Listed		8	F14	009
>10	Siemens Power Corporation	2101	Symons St	UST			9	C20	001
10	JRT Electric, Inc.	1999	Horn Rapids Rd	UST	RCRA Listed		9	F01	002
1	Garrett Electric Company, Inc.	284	Butler Loop Rd	S			9	F03	064
1	Garrett Electric Company, Inc.		Walleian Way	S			9	F03	367

**CITY OF RICHLAND
WELLHEAD PROTECTION PLAN
INVENTORY OF POTENTIAL CONTAMINATORS**

TOI Zone	BUSINESS NAME	NUMBER	BUSINESS ADDRESS STREET NAME	CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bus. Lic. CAT	R. Bus. Lic. SEC
>10	Armal Medical Center	1530	Jedwin Ave	M			17	A05	002
>10	Richland Animal Hospital	2686	George Washington Way	M			17	A06	006
5	Heston Vision Clinic	708	George Washington Way	S			17	A08	001
>10	Uptown Vision Center, Inc. PS	1336	Wellisan Way	S			17	A11	005
1	Foreberg Chiropractic Services	325	Torbett St	S			17	A11	002
>10	Gettings Chiropractic Clinic, P.S.	300	Jedwin Ave	S			17	A11	003
5	Kary Chiropractic Center, P.S.	360	Jedwin Ave	S			17	A11	004
10	Lundigan Chiropractic	1013	Williams Blvd	S			17	A11	005
>10	Oberg Chiropractic Office, Inc.	604	Jedwin Ave	S			17	A11	006
5	Such Chiropractic Office	636	George Washington Way	S			17	A11	010
>10	Desert Spring Chiropractic	1381	By-Pass Hwy	UST			17	805	001
>10	Richland Crematory Association, Inc./Einan's Funeral Home	915	George Washington Way	M	L		17	F01	003
5	Omnit Dental Lab	760	Wellisan Way	UST			17	F03	036
1	Gerard J. McMillin, Inc. (Zygotech)	268	Battelle Blvd	UST			17	F04	001
1	Battelle Pacific Northwest Labs	902	E End Horn Rapids Rd	RCRA Listed			17	F04	001
>10	Battelle Pacific NW Lab Benton Bl	3110	Port of Benton Blvd	RCRA Listed			17	F04	001
1	Battelle Northwest	3200	Stevens Dr	M			17	F04	001
5	Battelle Pacific NW Lab Stevens D	2400	Stevens Dr	RCRA Listed			17	F04	007
>10	Scientific Ecology Group, Inc.	1234	Columbia Dr SE	RCRA Listed			17	F04	010
1	Quanterra Env. Services/International Technology Corp	2800	George Washington Way	RCRA Listed	M		17	F04	014
1	Datschem Laboratories, Inc.	313	Wellisan Way	M			17	F04	029
>10	Innovative Technology Labs, Inc.	3100	George Washington Way	M			17	F05	039
>10	Campbell's Town & Country Kennels	1940	Jones Rd	S			17	F05	064
>10	Intermountain Materials Test	927	Columbia Dr. SE	S			17	F06	120
>10	Hanford Environmental Health	3070	George Washington Way	M			17	F06	300
>10	Old Heritage Taxidermy Workshop	100	Cameron Ave	M			17	F06	
5	Geosafe ISV Treability Test	680	5th Street	RCRA Listed			17		
>10	Columbia Spay and Neuter Clinic	916	Columbia Dr SE	M			17		
1	Research & Technology Center	2955	George Washington Way	RCRA Listed			17		
6	Riverside Dental Facility	750	George Washington Way	UST			17		
1	The Eagle Inn	2993	George Washington Way	UST			17		
5	Desert Veterinary Clinic, Inc.	42	Goethals Dr	M			17		
5	Life Care Center of Richland	44	Goethals Dr	M			17		
>10	Geosafe ISV Treability Test	3015	Horn Rapids Rd	RCRA Listed			17		
10	National Health Labs, Inc.	1076	Jedwin Ave	M			17		
>10	Bio-Medical Labs - Richland	953	Stevens Dr	M			17		
>10	Environmental Engineering & Testing	243	Symons St	M			17		
1	Vista Optical #093	101	Wellisan Way	S			17		
>10	Baird Cutting Tools, Inc.	806	Columbia Dr SE	M			18	C14	169
>10	Moore's Precision Machine	1119	Columbia Dr SE	M			18	F01	030
1	Richland 2800	313	Wellisan Way	M			18	F07	023
>10	Waldtech Aero	1901	Terminal Dr	M			18	C06	006
>10	Palta Paint	1368	Jedwin Ave	M			19	GLOSED	
1	Stevens Auto Airs	22	Wellisan Way	RCRA Listed			19	F06	065
>10	Tri-City Paintball	2003	Van Gieson St	M			19	F06	245
5	AAA Shops	1941	Saint St	M			19	F07	006
1	P&K Auto Service Inc	1415	Gillespie St	UST			19	F07	009
1	Atomic Body Shop III/Atomic Detail	72	Wellisan Way	M			19	F07	011
>10	Fine Lines Custom Paint & Body/Fine Lines	278	Wellisan Way	M			19	F07	023
>10	Columbia Busn Auto Body	1167	Carson St	M			19	F07	023
1	Atomic Body Shop	520	Wellisan Way	RCRA Listed	M		19		
1	Palta Paint	292	Wellisan Way	RCRA Listed			19		
10	Wendland's Photography	803	Willard Ave	M			20	B02	001
>10	Marlin's Columbia Photos	1367	George Washington Way	M			20	B02	004
>10	Butternut Photography	1610	Butternut Ave	M			20	B02	005
1	Imaseasy	422	Deirdred Ave	M			20	B02	008
5	Zinn Photography, Inc.	610	The Parkway	M			20	B02	012
>10	Washington 1-Hour Photo	1257	Guyar Ave	S			20	F06	361
>10	Artography, Inc.	2560	George Washington Way	S			20	F06	415
>10	Franklin Hausman, Photographer	900	Chestnut Ave	M			20		
10	J's School Portraits	1300	Columbia Center Blvd	M			20		
10	Studio K	2119	Newcomer St	M			20		
5	Ted Pedersen Photography	2155	Stevens Dr	M			20		
10	Owens-Corning Fiberglass	2081	Butler Loop	UST			21	CLOSED	309
>10	Xerox Corporation	1311	George Washington Way	S			22	F06	002
>10	Fraser's Printing	1301	Jedwin Ave	S			22	F26	

**CITY OF RICHLAND
WELLHEAD PROTECTION PLAN
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TOT Zone	BUSINESS NAME	NUMBER	BUSINESS ADDRESS STREET NAME	CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bus. Lic. CAT	R. Bus. Lic. SEQ
>10	High Impact Press (HIP)	302	Torbatt St	S			22		
>10	Quick Refrigeration Service	708	Symona St	M			26	F24	010
>10	Delta Heating & Cooling, Inc.	1807	Columbia Dr SE	M			25		
6	Desert Heating & Cooling, Inc.	1007	Lee Blvd	M			25		
1	Clark's Heating & Cooling, Inc.	3248	Wellshire Loop				25		
1	Bald Storage & Transfer	213	Wellshire Way	M			28	F05	027
6	Bassett Transit, Inc.	95	Goethals Dr	M			28		
>10	Airborne Freight Corporation	1901	Terminal Dr	M			28		
1	Boys & Girls	220	Washington Blvd				28		
1	Boys & Girls	314	Washington Blvd				28		
6	Ever Water Conditioning	78	Wellshire Way				27	F02	088
6	Bowers Water Conditioning	90	Jadwin Ave	S			27	F05	078
>10	American Pool-N-Spa	1300	Columbia Center Blvd	M			27	F13	004
>10	Pool Care	1019	Columbia Dr SE	M			27	F13	008
>10	Barker Enterprises	2042	Harris Ave	M			27	C14	048
>10	TMT Construction	174	Calla Del Sol	M				CLOSED	
1	Cole Enterprises	80	Wellshire Way	M				CLOSED	
1	Eloc, Inc.	104	Wellshire Way	S				CLOSED	
6	Mildred Lawrence/Lawrence Rentals	2201	Humphreys	UST				E03	001
1	Central Storage	310	Wellshire Way					F05	003
1	Wellshire Way	104	Wellshire Way					F05	012
>10	Varsity Homes, Inc.	827	Columbia Dr SE	M				F03	078
>10	Rico Inc/All Pro, Inc.	1232	Columbia Dr SE	UST				F03	077
6	Grant Land Company/George A. Grant, Inc.	1333	Gillespie St	UST	M			F03	119
1	Bresina Construction	90	Wellshire Way	M				F03	127
>10	Siefken & Sons Construction	1306	Manfield St	M				F03	262
>10	Clancy's Transfer & Storage	1100	Columbia Dr SE	M				F06	133
5	Allied Technology Group, Inc.	2026	Battelle Blvd	L				F06	198
>10	D&D Rentals	1221	Columbia Dr SE	S				F06	009
6	Abadan - Tri-Cities	617	The Parkway	S				F06	040
1	Protrain Sys.	690	George Washington Way	L				F06	125
6	General Telephone Co. of NW, Inc.	762	George Washington Way	M				F06	177
>10	Prestige Homes, Inc.	W/I	City Limits	S				F27	006
>10	Mechanical Constructors	2800	SR 240	S					
>10	Trico Contracting, Inc.	2801	SR 240	M					
>10	Woodmark Homes, Inc.	2800	SR 240	M					
1	Grant Land, Inc.	5008	Wellshire Way	RCRA Listed					
>10	Frank Murphy & Sons, Inc.	1015	Columbia Dr SE	S					
>10	J & D Sales	1829	Columbia Dr SE	S					
>10	Independence Square	1788	Fowler St	UST					
>10	Falcon Development	1815	George Washington Way	S					
10	Dynamic Homes, Inc.	1301	Jadwin Ave	S					
10	Interwest Telecom Services Corp	2000	Loyton Blvd	S					
>10	United Telephone Co of the Northwest	4600	New 200 E Hanford	UST					
>10	United Telephone Co of the Northwest		New Gate 23 Hanford Area	UST					
>10	United Telephone Co of the Northwest	244	Orchard Way	S					
10	Barrhill Enterprises	1605	SE Ogden St	S					
10	Holt Joseph C	2419	Swift Blvd	S					
>10	The Jagged Underground	1308	Torbatt St	S					
6	Arma Richard Park	955	W Leasy	UST					
1	Arma Richard Park	213	Wellshire Loop						
1	Arma Richard Park	410	Wellshire Loop						

TOT zone: number equates TOT in years
 Richland performed survey around TOT. These businesses were identified and queried for potential contaminants
 N/A = business closed
 Shaded rows equate to businesses that were not listed during the database query.

**CITY OF RICHLAND
WELLHEAD PROTECTION PLAN
INVENTORY OF POTENTIAL CONTAMINATORS**

Zone	BUSINESS NAME	NUMBER	BUSINESS ADDRESS	CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bus. Lic. CAT	R. Bus. Lic. SEC
1	Battelle Pacific Northwest Labs	902	Battelle Blvd	UST			17	F04	001
1	Imagery	472	Delfield Ave	M			20	B02	006
1	The Southland Corp 2304-26088/7-11 #2301-26412C	2411	George Washington Way	UST			15	C19	024
1	Quanterra Env. Services/International Technology Corp	2800	George Washington Way	RCRA Listed	L		17	F04	010
1	Artography, Inc.	2950	George Washington Way	S	M		20	F06	415
1	Geosafe Corporation	2950	George Washington Way	L			17	F06	126
1	Research & Technology Center	2955	George Washington Way	RCRA Listed			17		
1	Supply System Corp Headquarters	3000	George Washington Way	UST			99		
1	The Pacific Ink	3995	George Washington Way	UST			17		
1	P&K Auto Service Inc	1415	Gillespie St	UST			19	F07	008
1	Hertz Car Sales	825	Goethals Dr	M			2	T01	002
1	Battelle Pacific NW Lab Benton Bl	3110	Port of Benton Blvd	RCRA Listed			17	F04	001
1	Western Sintering Co., Inc.	2620	Stevens Dr	Toxic Release			11	F01	004
1	Battelle Northwest	3200	Stevens Dr	M			17	F04	001
1	Drywall Interiors	516	Warehouse St	S			6	F03	367
1	WV Park Services	130	Washington Loop				3		
1	Green Map Stores	210	Washington Loop				25		
1	Truck Truck Park	220	Washington Loop				24		
1	P&K Distribution	218	Washington Loop				24		
1	Battelle Northwest	410	Washington Loop				2	CLOSED7	
1	Motoring Svcs, Inc.	418	Warehouse Loop	RCRA Listed			2	F07	003
1	Lea Line Up and Tires	420	Warehouse Loop	RCRA Listed			2		
1	Painting & Spacing, Inc	248	Washington Loop				23		
1	191 Plumbing	240	Washington Loop				1		
1	Radline Automotive	77	Wellian Way	M			21	CLOSED	066
1	Stevens Auto Arts	72	Wellian Way	RCRA Listed			19	CLOSED	
1	Atomic Body Shop II/Atomic Detail	72	Wellian Way	M			2	CLOSED	009
1	Victory Racing	76	Wellian Way	M			2		
1	WV Park Services	28	Wellian Way				21	CLOSED	066
1	WV Park Services	80	Wellian Way	M			1	CLOSED	066
1	Cole Enterprises	87	Wellian Way				1	CLOSED	066
1	B&B Enterprises - Welding	86	Wellian Way	M			2	F06	139
1	Bresina Construction	90	Wellian Way	M			2	F03	127
1	Mav's Automotive Repair	100	Wellian Way	M			2	CLOSED	
1	Cascade Battery Warehouse	100	Wellian Way	M			3	CLOSED	
1	Wondrack Distributing Inc.	100	Wellian Way	UST			16	CLOSED7	
1	Tri-City Cleaners	101	Wellian Way	M			8	CLOSED	
1	Vista Optical #093	101	Wellian Way	S			17		
1	Eloc, Inc.	104	Wellian Way	S			2	CLOSED	
1	The Glass Works	108	Wellian Way	S			6	F03	578
1	WV Park Services	110	Wellian Way				17	CLOSED	066
1	WV Park Services	110	Wellian Way				17	CLOSED	066
1	Craftmen Floor Covering	122	Wellian Way	S			6	C14	188
1	Ballard Storage & Transfer	213	Wellian Way	M			26	F06	077
1	Northwest Rental Center, Inc.	225	Wellian Way	S			2	F05	361
1	Gerald J. McMillin Inc (Zygotech)	268	Wellian Way	UST			17	F03	036
1	Fine Lines Custom Paint & Body/Fine Lines	278	Wellian Way	M			19	F07	011
1	Hi Tec Hobby's	284	Wellian Way	M			2	C14	089
1	Garrett Electric Company, Inc.	284	Wellian Way	S			6	F03	367
1	Atomic Auto Sales	292	Wellian Way	M			2		
1	Sun West, Inc.	296	Wellian Way	M			2	C10	004
1	Deterchem Laboratories, Inc.	301	Wellian Way	M			17	F04	014
1	Foreberg Chiropractic Services	313	Wellian Way	M			17		
1	Motoring Svcs, Inc.	327	Wellian Way	RCRA Listed	M		17	A11	002
1	Budget Car & Truck Rental	500	Wellian Way	S			2	F08	004
1	Desert Air Salsbats & Equipment	500	Wellian Way	M			2	F08	004
1	Richard Motorcycle	516	Wellian Way	S			4	C14	004
1	Atomic Body Shop	520	Wellian Way	RCRA Listed	M		19	F06	148
1	Richard Industrial	500A	Wellian Way	S			6	C13	004
1	Grant Land, Inc.	500B	Wellian Way	RCRA Listed			3		
1	P&K Distribution	555	Wellian Way	RCRA Listed			3	F07	023

**CITY OF RICHLAND
WELLHEAD PROTECTION PLAN
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TOT Zone	BUSINESS NAME	NUMBER	BUSINESS ADDRESS		CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bus. Lic. CAT	R. Bus. Lic. SEQ
			STREET NAME	CITY						
1	Conk Automotive	90	90B	Wellman Way	RCRA Listed	M	2	F14	F07	007
1	City Cab	903		Wellman Way			3	F07	F07	007
1	Industrial Cabinetry	1351		Wyman St	S		6			
1	Richard Johnson Electric	1351		Wyman St	S		6			
1	Goede ISV Treatability Test	580		5th Street	RCRA Listed		17	F08		187
5	Aaron Way Cardlock/Wonack Distributing, Inc.	917		Aaron Dr	UST	L	16	F10	F05	001
5	Allied Technology Group, Inc.	2025		Battelle Blvd	L		16	F05		198
5	Recontek of Washington	2109		Battelle Blvd	RCRA Listed	Injection Well	89	CLOSED		
5	Stevens Blvd				M		2	F03		028
5	Trenstate Alphat Co.	63		George Washington Way	UST		2			
5	Sham-Na-Pum Golf Course	72		George Washington Way	UST		14			
5	Jackpot 059/Goodman's Jackpot Food Mart	600		George Washington Way	UST	L	15	C19		001
5	Automotive Wholesalers Inc	601		George Washington Way	RCRA Listed		2			
5	Top Auto, Inc. Richland	601		George Washington Way	UST		2			
5	USA Holding Inc dba Tremain	601		George Washington Way	M		3	F07	F05	008
5	Tri-Cities Battery, Inc.	660		George Washington Way	M		17	F05	F06	177
5	Protein Sys.	706		George Washington Way	S		17	A08		001
5	Heaton Vision Clinic	750		George Washington Way	M		17	F01		003
5	Omnit Dental Lab	750		George Washington Way	UST	M	17	F03		119
5	Riverdale Dental Facility	1333		Gilgaspie St	UST		2	F07		014
5	Tri-City Towing	1415		Gilgaspie St	M		17			
5	Desert Veterinary Clinic, Inc.	42		Goethals Dr	M		17			
5	Life Care Center of Richland	44		Goethals Dr	M		2			
5	R & R Emergency Road Service	95		Goethals Dr	S		2			
5	Bessett Transfer, Inc.	95		Goethals Dr	M		26			
5	Chick-Cook Wash	1104		Goethals Dr	M		2			
5	Chick-Cook Wash	1104		Goethals Dr	M		2			
5	Richard Laundry & Dry Cleaning Inc/US Linen	1108		Harding St	UST	RCRA Listed	8	F14	F03	005
5	Mildred Lawrence/Lawrence Rentals	2201		Humphreys	UST		8	F04		001
5	Bowers Water Conditioning	90		Jedwin Ave	S		27	F05		172
5	Such Chiropractic Office	638		Jedwin Ave	S		17	F05		008
5	Kay Chiropractic Center, P.S.	680		Jedwin Ave	S		17	A11		004
5	Federal Building US Post Office/USGSA	825		Jedwin Ave	UST	RCRA Listed	-99			
5	City of Richland Energy SVC Dept/WMTIP	566		Leacy	UST	RCRA Listed	-99			
5	Three Rivers Janitorial Supply	172		Leavelwood Ct	M		7	C14		101
5	Gene & Tune-Up/Tri-City Oil/Closed	1007		Lee Blvd	UST		15	CLOSED		
5	Desert Heating & Cooling, Inc.	1007		Lee Blvd	M		25			
5	Trustworthy Hardware	1010		Lee Blvd	S		16	C08		002
5	Perfection Tire	1113		Lee Blvd	M		2	F06		359
5	Payless Drug Store #2060	1268		Lee Blvd	M		16	C03		009
5	L&L Exxon	1315		Lee Blvd	UST	L	15	CLOSED		
5	P&K Self Serve	1325		Lee Blvd	L		15	C14		240
5	Sgt. Bub's Army Stores/Columbia Oil Co.	1345		Lee Blvd	L		15	C14		
5	Richland Central Office (4580-801)	751		Manfield St	UST		-99			
5	New Richland Central Office (4581-801)	752		Manfield St	UST		-99			
5	General Telephone Co. of NW, Inc.	1300		Manfield St	S		2	F27		005
5	Equip Maint/City of Richland	630		Manfield St	UST	RCRA Listed	2			
5	Stoneway Electric Supply, Inc.	1941		Railroad St	S		9			
5	AAA Shops	1997		Saint St	M		19	F05		245
5	City of Richland	2013		Saint St	RCRA Listed		-99			
5	Lamb Weston Inc. Richland	616		Saint St - P.O. Box 699	UST	RCRA Listed	13	F02		007
5	Richland SD 400 Admin Off	616		Snow Ave	RCRA Listed	Injection Well	-99			
5	Stevens Dr			Spangler/Saint Stevens	RCRA Listed		-99			
5	US Bank Facility	701		Stevens Dr	UST		18			
5	New City Cleaners Richland	747		Stevens Dr	UST		8	F14		007
5	Flying J, Inc. #1111/Neighbor's Conoco	780		Stevens Dr	L		16	C19		013
5	Standard Paint & Wallpaper, Inc.	797		Stevens Dr	M		6	C14		115
5	Les Schwab Tire Center #333	837		Stevens Dr	S		2	F07		015
5	Poyner's Rhd Motor Supply, Inc.	843		Stevens Dr	M		2	F06		003
5	Taylor Automotive Parts, Inc.	877		Stevens Dr	M		2	C01		004
5	Ted Pedersen Photography	2155		Stevens Dr	M		20			
5	By Pass Deli Mart	2201		Stevens Dr	UST	L	16	C19		019
5	Pat Murphy Enterprises	2243		Stevens Dr	M		2	F07		020
5	Battelle Pacific NW Lab Stevens D	2400		Stevens Dr	RCRA Listed		17	F04		001
5	Thayer Dr	714		Thayer Dr	UST		2			

**CITY OF RICHLAND
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101 Zone	BUSINESS NAME	NUMBER	BUSINESS ADDRESS	STREET NAME	CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bur. Lic. CAT	R. Bur. Lic. SEC
6	Abadan - Tri Cities	617		The Parkway	S			6	F06	040
6	Huck & Floor Covering, Inc.	703		The Parkway	S			6	C14	069
6	Acme Richland Plant	956		W Lacey	UST			6	C07	007
10	Copeland Lumber Yards, Inc.	1360		Aaron Dr	UST	S		2	CLOSED	
10	V and M Offroad Performance	113		Banham St	M			21	C01	008
10	Washington Industrial Supply	508		Borcas Ct	S			2	F03	004
10	Ovens-Corling, Fiberglass	2061		Butler Loop	UST			14	F06	168
10	RJR Sales	1976		Butler Loop Rd	M			17	A11	006
10	JRT Electric, Inc.	1999		Butler Loop Rd	S			17		
10	Richland Airport	700		Control Tower Ramp Area	UST			1		
10	Meadow Springs Country Club	1013		Country Club Pl	S			4	F03	262
10	Lundrigan Chiropractic	1013		Jadwin Ave	S			6		
10	National Health Labs, Inc.	1076		Jadwin Ave	S			16		
10	Dynamic Homes, Inc.	1301		Jadwin Ave	S			20		
10	Design Works, Inc.	2000		Logston Blvd	S			99		
10	Interwest Telecom Services Corp	2000		Logston Blvd	S			99		
10	Siefken & Sons Construction	1306		Manfield St	M			16		
10	A&B Marine Repair	1330		Nevada Avenue SE	M			16		
10	Stone's Carpet Installation	509		Newcomer St	S			2	A03	005
10	Dani's Sporting Goods	804		Newcomer St	S			16	C03	009
10	Studio K	2119		Newcomer St	M			16	C03	008
10	Harris Ave			Newcomer/Willis	Injection Well			11	C19	012
10	Herrick Ave			Newcomer/Willis	Injection Well					
10	Bernhill Enterprises	1506		SE Orpden St	S					
10	Hwy 240			Snyder	Injection Well					
10	Medical Center Pharmacy	976		Stevens Dr	M			16		
10	Bio-Medical Labs - Richland	953		Stevens Dr	M			17		
10	Health Care Pharmacy	969		Stevens Dr	M			16		
10	City of Richland	505		Swift Blvd	UST			99		
10	Clinical Laboratory, PS	780		Swift Blvd	M			17	A03	005
10	Richland Clinic Pharmacy	800		Swift Blvd	M			16	C03	009
10	Prescription Pharmacy	800		Swift Blvd	M			16	C03	008
10	Kadlec Medical Center Physical Plant	888		Swift Blvd	UST			2		
10	Swick Shop	2130		Swift Blvd	UST			11	C19	012
10	Hot Joseph C	2419		Swift Blvd	RCRA Listed					
10	Richland Airport			Terminal Building Ramp	UST			99		
10	Wendland & Photography	803		Willard Ave	M			20	B02	001
10	Bull & Eye Gun Sales	1039		Willard Ave	S			16		
10	The Southland Corp 2304-144287-11#2301-14428F	415		Wright Ave	UST	L		16	C19	010
10	Buck & Joe's Exxon/Closed	1001		Wright Ave	UST			16	CLOSED	
10	Densow Drugs	1011		Wright Ave	M			16	C03	010
10	Vacuum City	1019		Wright Ave	S			16	C14	162
10	McCall Oil, Generators, Generators	1023		Wright Ave	UST			16		
>10	Badger Hill Remote Radio (4430-B01)	U-46		14.02(LG:119.05/3 MI SW RC	UST			99		
>10	Penwest Foods Company	216		Ter St	L			99		
>10	Matroffing Inc	111		Airport Property	UST	Toxic Release		16		
>10	Ash Substation			Ash Rd	UST			16		
>10	Reese Farm			Badger Canyon & Sellards Rds	UST			14		
>10	Shotguns Limited	501		Berkshire St	S			16	C10	009
>10	Butternut Photography	1510		Butternut Ave	UST			20	B02	006
>10	Richland Cemetery Association, Inc./Einan's Funeral Home	915		By-Pass Hwy	UST	L		17	B06	001
>10	TNT Construction	174		Cable Dns Sds	M			19	CLOSED	
>10	Columbia Basin Auto Body	1167		Carson St	M			19	F07	023
>10	Hobbs Ave			Catfish St	Injection Well			99		
>10	Franklin Heurman, Photographer	800		Chestrnut Ave	M			20		
>10	Old Heritage Taxidermy Workshop	100		Chimarron Ave	M			17	F06	300
>10	A&V Lawn Service	W/I		City Limits	M			14		
>10	Prestige Homes, Inc.	W/I		City Limits	S			6	F03	440
>10	B & R Herwood Floors, Inc.	1300		Columbia Center Blvd	S			16	C19	021
>10	Richland Gulf #1026	1300		Columbia Center Blvd	UST	L		20		
>10	J's School Portrait	1300		Columbia Center Blvd	M			27	F13	004
>10	American Pool-N-Spa	1300		Columbia Center Blvd	M			2	C14	091
>10	Bert's Auto Den, Inc.	1327		Columbia Center Blvd	UST			16	CLOSED	
>10	Unocal 6151/Closed	1400		Columbia Center Blvd	M			2	C14	094
>10	C&P	1417		Columbia Center Blvd	M			2	C14	169
>10	Baird Cutting Tools, Inc.	805		Columbia Dr SE	M			2	C01	009
>10	Inland Northwest Distributing	911		Columbia Dr SE	S			3		
>10	Standard Batteries	916		Columbia Dr SE	M			17		
>10	Columbia Spray and Neuter Clinic	916		Columbia Dr SE	M			2		
>10	U-Heal Center of Richland	939		Columbia Dr SE	UST	RCRA Listed		2	F06	384

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TOT Zone	BUSINESS NAME	NUMBER	STREET NAME	CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bus. Lic. CAT	R. Bus. Lic. SE0
>10	Readline Motor Sports/European Auto	951	Columbia Dr SE	M				F07	004
>10	Ben Franklin Transit Richland	1000	UST	RCRA Listed			2		
>10	Frank Murphy & Sons, Inc.	1016	Columbia Dr SE	S			2		
>10	Reco Inc/All Pro, Inc.	1232	Columbia Dr SE	UST				F03	077
>10	Scientific Ecology Group, Inc.	1234	Columbia Dr SE	RCRA Listed			17	F04	007
>10	Sundown Marine/Auto, Inc.	1238	Columbia Dr SE	M			2	C10	006
>10	Hobie Cat Sport & Sail	1238	Columbia Dr SE	M			4		
>10	Delta Heating & Cooling, Inc.	1607	Columbia Dr SE	M			26		
>10	Chem-Add Services, Inc.	1615	Columbia Dr SE	M			7		
>10	J & D Sales	1829	Columbia Dr SE	S					
>10	The Boat Shop Marine Inc	1776	Columbia Dr SE	UST			4		
>10	Varsity Homes, Inc.	827	Columbia Dr SE	M				F03	076
>10	Intermountain Materials Test	927	Columbia Dr SE	S			17	F06	054
>10	U-Heal Center of Richland	939	Columbia Dr SE	S			2		
>10	Pood Care	1019	Columbia Dr SE	M			27	F13	008
>10	Clancy's Transfer & Storage	1100	Columbia Dr SE	M				F06	133
>10	Moore's Precision Machine	1119	Columbia Dr SE	M			18	F01	030
>10	A to Z Pest Control	1156	Columbia Dr SE	S			14	F06	002
>10	D&D Rents	1221	Columbia Dr SE	S			14	F06	009
>10	Hovercraft Unlimited		Columbia Pnt Pk	M			4		
>10	Pappy & The Stripper (Amity)	1300	Dakota Ave	RCRA Listed	L		12	F06	216
>10	Forest Ave		Dogwood	Injection Well			99		
>10	Battelle Pacific NW Lab		E End Horn Rapids Rd	RCRA Listed			17	F04	001
>10	Badger Mini Mart	805	E Kennedy Rd	L			16		
>10	Independence Square	1766	Fowler St	UST					
>10	Lorne Banquet Ford/Dodge, Inc.	1776	Fowler St	UST	RCRA Listed	M	2	F06	001
>10	Japanese Engines and Transmissions, Inc.	1900	Fowler St	RCRA Listed	M		2	C01	001
>10	#19 Gage Blvd - Tri City Oil	106	Gage Blvd	UST			16		
>10	Magnum Electric Service, Inc.	1039	Genera St	S			9		
>10	Print Plus	1306	George Washington Way	S			22		
>10	Xerox Corporation	1311	George Washington Way	S			22	F06	309
>10	Uptown Vision Center, Inc. PS	1336	George Washington Way	S			17	A08	006
>10	Marlin's Columbia Photos	1367	George Washington Way	M			20	B02	004
>10	Desert Spring Chiropractic	1381	George Washington Way	S			17	A11	010
>10	#2 Geo Wash Way - Tri City Oil/Sun Mart #2	1401	George Washington Way	UST	L		16	C19	016
>10	Chevron USA Inc. Pkg McGee/McGee's Chevron	1601	George Washington Way	UST	RCRA Listed	L	16	F10	013
>10	Ernst #261	1717	George Washington Way	S			18	CLOSED	001
>10	Payless Drug Store #2062	1743	George Washington Way	M			18	C03	
>10	Falcon Development	1816	George Washington Way	S					
>10	One Hour Cleaners	1823	George Washington Way	M			8	F14	003
>10	7-11 2304-26821/Closed	1824	George Washington Way	UST			16	CLOSED	
>10	Malley's Pharmacy	1906	George Washington Way	M			18	C03	006
>10	Wheeler Co. Gun Shop	1908	George Washington Way	S			16		
>10	Harford Environmental Health	3070	George Washington Way	M			17	F05	120
>10	Innovative Technology Labs, Inc.	3100	George Washington Way	M			17	F06	029
>10	Washington 1-Hour Photo	1267	Guyer Ave	S			20	F06	361
>10	Barker Enterprises	2042	Harris Ave	M				C14	048
>10	Siemens Power Corporation	2101	Horn Rapids Rd	UST	RCRA Listed	L	9	F01	002
>10	Geosafe ISV Treatability Test	3016	Horn Rapids Rd	RCRA Listed			17		
>10	WDOE CRO Variable Rest Area		Hwy 24	UST			99		
>10	#5 Jedwin & Williams Tri City Oil		Jedwin & Williams	UST			16		
>10	Ernie's Printing	1301	Jedwin Ave	S			22	F25	002
>10	AI's Auto Supply #334	1307	Jedwin Ave	M			2	C01	005
>10	Benjamin's, Inc.	1324	Jedwin Ave	S			6	F03	256
>10	Parker Paint	1368	Jedwin Ave	M			19	C08	009
>10	The Great Soap Opera Dry Cleaners	1370	Jedwin Ave	RCRA Listed	M		8	F14	009
>10	B B & M, Inc.	1382	Jedwin Ave	S			2	C10	001
>10	Tim Bush Motor Company, Inc.	1402	Jedwin Ave	M			2	C14	072
>10	Jed/Closed	1402	Jedwin Ave	UST			15	CLOSED	
>10	Shuck's Auto Supply/Northern Automotive Corp	1440	Jedwin Ave	M			2	C01	003
>10	Animal Medical Center	1530	Jedwin Ave	M			17	A06	002
>10	The Southland Corp 2304-26088/7-11 #2301-26088A	1540	Jedwin Ave	UST	L		16	C19	022
>10	Vacuum Rending Specialties	1851	Jedwin Ave	M			2		
>10	James Dixon/Chevron USA Inc. SS97942/Dixon Chevron	1903	Jedwin Ave	UST	RCRA Listed	L	16	F10	002
>10	Air-O Design & Business Forms	1956	Jedwin Ave	S			18		
>10	Campbell's Town & Country Kennels	1940	Jones Rd	S			17	F06	039
>10	Badger Mini Mart	805	Kennedy Rd	UST			16	C19	008
>10	Richland High School Auto Repair S	930	Long Ave	RCRA Listed			2		
>10	Richland Yacht Club	20	Marina Park Dr	UST			4		
>10	Color Tile	1228	Montana St	M			6	C13	006

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TOT Zone	BUSINESS NAME	NUMBER	BUSINESS ADDRESS		CATEGORY	CATEGORY	CATEGORY	CLASS ID	R. Bur. Lic. CAT	R. Bur. Lic. SEC
			STREET NAME							
>10	United Telephone Co. of the Northwest	4600	Near 200 E Harford		UST					
>10	United Telephone Co. of the Northwest		Near Gate 23 Harford Area		UST					
>10	Dynacom Systems	244	Orchard Way		S					
>10	Quellwood		Palmes Ct		Injection Well					
>10	Interstate Nuclear Services	2424	Robertson Dr		M				F14	008
>10	Benton County Fire District #4	Box 3980	Route 1		UST					
>10	US Ecology, Inc.	PO Box 838	Sec 9 TNSP T2N R26EWM		UST					
>10	Washington State University Tri Ci	100	Sprout Rd		RCRA Listed					
>10	Harris Ave		Sprout/Spring		Injection Well					
>10	Mechanical Constructors	2800	SR 240		S					
>10	Woodmark Homes, Inc.	2800	SR 240		M					
>10	Trico Contracting, Inc.	2801	SR 240		M					
>10	Richland Landfill		SR 240 & Groscup Rd		UST					
>10	WDOE CRD WDOT Columbia River Brg	MP 43.80	SR24		RCRA Listed					
>10	North Richland Contr.# Office (4490-802)	2600	Stevens Dr (N. Richland)		UST					
>10	Radar Electric Co., Inc.	222	Simons St		S					
>10	Environmental Engineering & Testing	243	Simons St		M					
>10	Daimax Upholstery	708	Simons St		S					
>10	Quick Refrigeration Services	708	Simons St		M					
>10	Pringles, Inc.	1508	Simons St		S					
>10	Harford Generating Project	1621	Terminal Dr		RCRA Listed					
>10	Richland Auto Repair, Inc.	1621	Terminal Dr		M					
>10	Richland Marine	1845	Terminal Dr		S					
>10	Chemcheck Instruments, Inc.	1801	Terminal Dr		UST					
>10	Richland Airport		Terminal Dr		M					
>10	Cooke Aviation	1901	Terminal Dr		M					
>10	Weldtech Aero	1901	Terminal Dr		M					
>10	Airborne Freight Corporation	1901	Terminal Dr		M					
>10	BC's Typography	214	Terbett St		S					
>10	Gettings Chiropractic Clinic, P.S.	300	Terbett St		S					
>10	High Impact Press (HIP)	302	Terbett St		S					
>10	Physicians Medical Center	310	Terbett St		M					
>10	The Jagged Underground	1308	Terbett St		S					
>10	Van Gleesen Car Wash	311	Van Gleesen St		M					
>10	Tri-City Paintball	2003	Van Gleesen St		M					
>10	Rocket Mart	2111	Van Gleesen St		UST					
>10	Westgate Shoe Repair	2185	Van Gleesen St		S					
>10	The Southland Cap 2304-2395/17-11 #2301-23951D	2185	Van Gleesen St		UST					
>10	Richland Animal Hospital	2688	Van Gleesen St		M					
>10	Dean's Auto Repair	2678	Van Gleesen St		M					
>10	Pat Murphy Enterprises	2076	Van Gleesen St		M					
>10	SunMart/Pump-N-Save #9/Tri-City Oil	108	W Gage Rd		L					
>10	Meadow Springs Car Wash	107	W Gage Rd		UST					
>10	Sun Mart #15	3957	W Van Gleesen		M					
>10	Davison/Harris		Williams Blvd		Injection Well					
>10	Curley's Texaco Service	294	Williams Blvd		UST					
>10	Uptown Shoe Repair	260	Williams Blvd		S					
>10	Rice's Carpetland	285	Williams Blvd		S					
>10	McCue's Repair & Towing	295	Williams Blvd		S					
>10	Pump-N-Save #5/Tri-City Oil	421	Williams Blvd		RCRA Listed					
>10	Oborg Chiropractic Offices, Inc.	604	Williams Blvd		L					
>10	Century Services, Inc./Yo's Washy Washy	1411	Williams Blvd		S					
>10	Super Lube	421	Williams St		M					
>10					UST					

TOT zone: number equates TOT in years
 Richland performed survey around TOT. These businesses were identified and queried for potential contaminants
 N/A = business closed
 Shaded rows equate to businesses that were not listed during the database query.

APPENDIX D
STAN MILLER CMU PAPER

Identification of Critical Materials Users Using a General Tabulation of Chemical Use and SIC Code

By Stan Miller, Program Manager
Spokane County Water Quality Management Program

Introduction

The Spokane Aquifer Water Quality Management Plan (Spokane County Engineers, 1979) identifies chemical waste disposal (Recommended Action III.5C) and chemical spills (Recommended Action III.5A & III.5B) as two of the most important sources of potential ground water contamination. In addition to the ordinary concerns of health, safety and environmental contamination associated with hazardous chemicals, the Spokane Aquifer posed a set of somewhat unique problems. First, areas with the shortest travel time to ground water contained most of the industrial activity located in the metropolitan area at the time the Plan was written. Second, the standard means of storm runoff management, the use of shallow injection wells, provided an even faster travel time by allowing spills on streets, roads and parking lots nearly instantaneous transport through the first 12 to 15 feet of the vadose zone (the vadose zone is the zone of unsaturated "soil" above ground water). The general policy established to reduce the risk of ground water contamination from spills and leaks called for some form of "secondary containment." In buildings this could be a traditional containment system such as impermeable liners and double wall tanks. For streets, roads and parking lots it would mean changing the entire storm runoff management scheme to eliminate the injection wells.

Studies of ground water contamination conducted in the Spokane Aquifer showed general deterioration in quality as well as specific problems associated with regulated substances. The general deterioration of water quality was associated with chemical tracers such as chloride and total dissolved solids with quite high criteria levels and very low ratings on most health hazard scales. It was felt that using the standard "hazardous waste" concept for determining which chemicals to regulate could result in not managing chemicals causing much of the general degradation; for example, salts used for winter road deicing.

A major problem involving semantics evolved. The general feeling was that the term "hazardous chemical" if applied to the chemicals of concern, could lead to confusion. Washington State had just adopted Hazardous Waste Regulations (WAC 173-303) that defined both extremely hazardous and dangerous in ways not suited to the concerns for Spokane's ground water quality protection goals. Federal law had similarly defined "Hazardous" both in waste management and chemical transportation regulations. To avoid confusion with these terms Spokane adopted "Critical Substance" (Recommended Action III.5a.01) as the descriptor for materials that were viewed as needing control for assuring Aquifer protection. The operational definition applied was: *a critical substance is any material stored, handled, transported or used over the Aquifer (within the Aquifer Sensitive Area) in such a quantity that if released could result in the violation of a beneficial use criteria in a water supply well.* When the Aquifer Sensitive Area Overlay Zone was drafted the term "critical material" was recommended as a better expression than critical substance. Based on the definition above, a facility would be a Critical Material Use Activity only if one or more listed chemicals, those for which beneficial use criteria and standards have been set, and the quantity exceeded the tabulated amount.

Procedure for Listing Critical Materials

The Critical Materials List includes two component, the list of materials for which criteria have been established and the quantity of material deemed to pose a threat to the beneficial use of ground water. Over the years several "lists" including water quality criteria and standards have been drafted by state and federal agencies. Those viewed as most relevant to Spokane County's ground water protection needs included the State Board of Health Maximum Contaminant Levels for drinking water (WAC 246-290-310), the Water Quality Standards for Ground Waters of the

State of Washington (WAC 173-200) and the environmental clean up standards of the Model Toxics Control Act (WAC 173-340). The tabulation of critical materials included in current regulations lists all chemicals specifically mentioned in the regulations described above. A simple dilution model was used to calculate the quantity of material necessary for a site to be defined as a critical material use activity. The critical quantity of a material was defined as the amount needed to raise the average concentration in 310 million liters (82 million gallons) of water to the criteria level (e.g. the drinking water MCL). The volume above corresponds to the water contained in a conical section of the aquifer with a length of 1600 meters (one-half mile) and a base radius of 42 meters (138 feet) and a porosity of about 40%. The half cone described approximates the shape of a plume emanating from a point source discharge into ground water. The cone length corresponds roughly to one-half the distance between water supply wells drilled into the Spokane Aquifer.

The specific recommendations for managing chemical storage, handling, transport and use ranged from requiring inventory and education, to spill containment and clean up planning, to locating facilities outside the Aquifer Sensitive Area. A facility would be placed in the Critical Material Use Activity class even if only one critical material were present. However, even if only one chemical were present, all areas where chemicals were used within a facility would be required to meet the ground water protection design and handling criteria. Implementing this range of activities required that a data base of activities (an inventory of businesses and industries) be developed and that several agencies collaborate in the management program.

Developing the Critical Material Use Activity List

In order to provide a starting point for the review of chemical use activities within the Aquifer Sensitive Area, the Critical Materials Use Activity List was created. This list included four basic elements: a general business class description, the Standard Industrial Classification Codes applied to businesses in the class, the types of chemicals prevalent in the use class and the amount of chemical kept at a typical site.

Local land use information, the Spokane Area Economic Development Council's Inland Northwest Manufacturers Guide (EDC, 1990), and the Standard Industrial Classification Manual (Office of Management and Budget, 1987) were used to develop the first two elements of the list. The type of material present was determined from surveys conducted by the Department of Ecology (1978) and URS Consulting Engineers (1979) as well as information provided on building permit applications (Dept. of Buildings). The amounts of materials present were determined from the ECOLOGY survey (Dept. of Ecology, 1978), Department of Buildings information and informal site surveys.

This compilation led to a Critical Materials Use Activity List. The List was keyed to the Standard Industrial Classification (SIC) Code because this code was used almost universally to classify business; the SIC code could be used to screen most business data bases for those businesses likely to have chemicals on site. The information on the list was known to be hypothetical. As a class, a business would be expected to have critical materials on site, however any specific instance could be an exception. While acceptable when used as a screening tool, regulation would require individual site inspections to verify critical material use activity.

The Critical Material Use Activity List was used to screen a business and industry data base for Spokane County for Critical Materials use. All businesses and industries with SIC codes attached to activities included on the Critical Materials Activities List were parsed from the master list. The business and industry list thus obtained became the priority list for field investigation. This process was conducted using the Spokane County Geographic Information System (Lackaff et al, 1993). Thus, the address list generated for critical materials users could be matched to locations in the geographic data base. A list of Critical Materials Use Activities for any specified geographic, such as a wellhead protection area, could then be quickly developed using the GIS technology.

Future Development Needs

The screening made possible using this process is preliminary only. As indicated above there are no doubt many exceptions to the general rules used to identify the type and quantity of material present. Only a field check of each potential user site can verify the presence of a chemical in the threshold quantity. Similarly, the process adopted for designating potential contaminant sources does not account for variations in mobility - adsorption and degradation - of chemicals. A mechanism could be developed to prioritize field verification based on these factors. It should be noted that the mechanism described for defining critical quantity accounts for variation in toxicity and quantity stored. These factors should not be used to prioritize field checks.

Land use and business activity is not static. Change is the norm. In order to maintain a useful record the Critical Materials Use Activity inventory needs to be continually updated. Currently no such mechanism exists; one needs to be developed. Most likely this will be accomplished by making field checking a cyclical process that is self correcting. New businesses will be added as the building permit or occupancy permit for a facility is issued. Businesses that change operations to eliminate critical materials from their site or that no longer operate at a site will be deleted from the list as the field verification cycle examines the facility.

Critical Materials Use Activity List

The list presented below includes, in addition to the four elements described above, the critical quantity and actual quantity of chemical expected on site for each activity. Critical quantity is provided both in "pure form" quantity and in terms of common units for the form of chemical likely to be found on site. For example the critical quantity for lead in automotive storage batteries is presented as kilograms of lead and in gallons of concentrated "lead sulfate/sulfuric acid" solution. Comparing quantities present with critical quantity is the mechanism for designation of an activity as a "Critical Materials Use Activity".

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Chemical Materials Use Activity List, Critical Materials Expected at Business Locations 01-Mar-95

Type of Business	SIC Codes	Possible Critical Material	CAS Number	Amount Expected on Site	Size of Unit	Critical Quantity in kg	Critical Quantity in gal or as noted
Art Materials & Supplies	5199	Isopropyl alcohol	67-63-0	5 gal	0.25 gal	226	76 gal
		Methyl alcohol	67-56-1	5 gal	0.25 gal	226	75 gal
		Hydrocarbon solvents	8032-32-4	5 gal	0.25 gal	323	133 gal as TPH
		Toluene	100-80-3	5 gal	0.25 gal	13	4 gal
		Methylene chloride	75-09-2	5 gal	0.25 gal	1.6	0.3 gal
Auto repair, parts, machine shops, service	5531	Gasoline, leaded	8006-61-9	10,000 ga	bulk	323	119 gal as TPH
	7538	Gasoline, unleaded	8006-61-9	10,000 ga	bulk	323	119 gal as TPH
	7549	Motor oil		150 gal	1 qt-55 gal	323	119 gal as TPH
	7537	Ethylene Glycol	107-21-1	60 gal	1 gal	250	61 gal
	5013	Methyl alcohol	67-56-1	60 gal	1 gal	226	75 gal
	5013	Lead in auto batteries	7439-92-1	5 gal	0.5 gal	1.6 as Pb	0.3 gal, 50% PbSO4 so
Batteries, retail, etc.	5013	Sulfuric Acid	7664-90-5	50 gal	5 gal	323 as SO4	46 gal
	5531	Lead in auto batteries	7439-92-1	25 gal	0.5 gal	1.6 as Pb	0.3 gal, 50% PbSO4 so
	5063	Gasoline, unleaded	8006-61-9	10,000 ga	bulk	323	119 gal as TPH
	3691	Ethylene Glycol	107-21-1	60 gal	1 gal	250	61 gal
repair & cleaning	4499	Acetone	76-64-1	50 gal	5 gal	1290	438 gal
	3732	Methyl ethyl ketone	79-93-3	50 gal	5 gal	645	212 gal
		Hydrocarbon solvents	8032-32-4	200 gal	55 gal	323	134 gal as TPH
		Epoxy Resins		50 gal	1 - 5 gal		
		Phenolic Glues		20 lb	1 lb		
Building Materials production & sales	2435	Pentachlorophenol	87-86-5	50 gal	1 gal	0.32	2 gal, 5% soln. w/v
	2436	Arsenic (compounds in soln.)	7440-38-2	100 gal	1 - 5 gal	16 as As	43 gal, 10% soln. w/v
	2439	Copper (compounds)	7440-50-8	50 gal	1 gal	323 as Cu	1784 lb as CuSO4
	2491	Chromium (compounds)	7440-47-3	50 gal	1 gal	16 as Cr	89 lb as Na2Cr2O7
	2492	Sodium Hydroxide (solution)	1310-73-2	100 gal	bulk	1683 as Na	1275 gal, 35% sol w/v
	1541	Urea - Formaldehyde Resins	50-00-0	20 lb	1 lb	1	0.8 gal, 35% sol w/v
	5251						
	5072						
	5211						
	5039						
1542							
Wood Preserving	2591	Pentachlorophenol	87-86-5	100 gal	1 - 5 gal	0.32	0.33 gal, 35% sol w/v
	2491	Arsenic (compounds in soln.)	7440-38-2	100 gal	1 - 5 gal	16 as As	43 gal, 10% soln. w/v
		Hydrocarbon solvents	8032-32-4	200 gal	55 gal	323	134 gal as TPH
		Copper (compounds in soln.)	7440-50-8	100 gal	1 - 5 gal	323 as Cu	4275 gal, 2% soln. w/v
Building Maintenance painting Supplies manufacturing and	7349	Sodium Hydroxide	1310-73-2	100 gal	1 gal	1683 as Na	1275 gal, 35% sol w/v
	2841	Isopropyl alcohol	67-63-0	50 gal	1 gal	226	77 gal
	2869	Dibutyl phthalate	84-74-2	10 gal	1 gal	182	965 gal, 5% sol w/v

Chemical Materials Use Activity List, Critical Materials Expected at Business Locations 01-Mar-95

Type of Business	SIC Codes	Possible Critical Material	CAS Number	Amount Expected on Site	Size of Unit	Critical Quantity in kg	Critical Quantity in gal or as noted
Distribution	5007	Sodium hexametaphosphate	10124-56-0	100 lb	1 lb	27 as P	59 lb as P
		tri-Sodium phosphate	10101-09-0	100 lb	1 lb	19 as P	42 lb as P.
Drycleaning Facilities	7215	Trichloroethene	79-01-6	20 gal	5 gal	1.6	0.3 gal
	7217	Tetrachloroethylene	127-10-4	200 gal	55 gal	1.6	0.3 gal
		1,1,1-Trichloroethane	71-55-6	20 gal	5 gal	65	13 gal
		Hydrocarbon solvents	8032-32-4	200 gal	55 gal	323	134 gal, as TPH
Electrical & Electronics Products & Mfg.	3641	Metal cyanide solution, 5%	57-12-5	300 gal	tank	65 as CN	171 gal, 10% CN soln.
	3662	Methylene chloride	75-09-2	50 gal	5 gal	1.6	0.3 gal
	3674	1,1,1-Trichloroethane	71-55-6	50 gal	5 gal	65	13 gal
	3677	Acetone	76-64-1	50 gal	5 gal	1292	437 gal
	3679	Methyl ethyl ketone	79-93-3	50 gal	5 gal	646	212 gal
	3811						
	3825						
3993							
Electroplating	3471	Metal cyanide solution, 5%	57-12-5	300 gal	tank	65 as CN	171 gal, 10% CN soln.
		tri-Sodium phosphate	10101-09-0	100 lb	1 lb	8 as P	42 lb as P
		Trichloroethene	79-01-6	25 gal	5 gal	1.6	0.3 gal
		Tetrachloroethene	127-10-4	25 gal	5 gal	1.6	0.3 gal
		Xylene, mixed isomer	1330-20-7	5 gal	1 gal	6	2 gal
Foundries	3321	Metal cyanide solution, 5%	57-12-5	200 gal	tank	65 as CN	171 gal, 10% CN soln.
	3322	Trichloroethene	79-01-6	5 gal	1 gal	1.6	0.3 gal
	3325	Isopropyl alcohol	67-63-0	55 gal	55 gal	226	77 gal
	3361	Sodium Hydroxide	1310-73-2	100	tank	1603	892 gal, 50% sol w/w
	3362	Formaldehyde	50-00-0	20 lb	1 lb	32	71 lb
	3369						
Furniture Refinishing	7641	Methylene chloride	75-09-2	100 gal	tank	1.6	0.3 gal
		Acetone	67-64-1	5 gal	1 gal	1292	437 gal
		Methyl ethyl ketone	79-93-3	1 gal	1 gal	645	212 gal
		Xylene, mixed isomer	1330-20-7	1 gal	1 gal	6	2 gal
		Hydrocarbon solvents	8032-32-4	10 gal	1 gal	323	134 gal
Garden Centers warehouse equip. Supplies	5261	Ammonium Nitrate	6404-52-2	1000 lb	25 lb	129 as NO3	811 lb as NH4NO3
	141	Ammonium Sulfate	7703-20-2	500 lb	25 lb	323 as SO4	443 lb as NH4SO4
		Potassium Chloride (mix)	7447-40-7	500 lb	25 lb	250 as Cl	1191 lb as KCl

Type of Business	SIC Codes	Possible Critical Material	CAS Number	Amount Expected on Site	Size of Unit	Critical Quantity in kg	Critical Quantity in gal or as noted
Landscape, Hort. Service	78 782 783	Copper Sulfate	7758-99-8	20 lb	0.5 lb	419	923 lb
		2-4-D	94-75-7	150 lb	0.5 lb	32	71 lb
		Glyphosate		60 gal	0.25 gal	226	324 gal as Concentra
		Simizene		25 lb	0.1 lb	1.3	2.8 lb
		Chlordane		25 lb	0.1 lb	0.6	1.4 lb
		Aldicarb		25 lb	0.1 lb	1.0	2.1 lb
Gasoline, retail	5541	Xylene, pesticide carrier	1330-20-7	100 gal	0.25 gal	6	2 gal
		Gasoline, unleaded	8006-61-9	20,000 ga	bulk	323	118 gal as TPH
		Gasoline, leaded	8006-61-9	10,000 ga	bulk	323	118 gal as TPH
		Ethylene glycol	107-21-1	120 gal	1 gal	258	61 gal
		Methyl alcohol	67-56-1	60 gal	1 gal	226	76 gal
		Diesel		10,000 ga	bulk	323	118 gal as TPH
		Lubricating oils		60 gal	1 qt	323	118 gal as TPH
Hardware Stores, retail	5251	Acetone	67-64-1	20 gal	1 gal	1292	437 gal
		Kerosene		50 gal	5 gal	323	118 gal as TPH
		Methyl Ethyl Ketone	78-93-3	5 gal	1 gal	646	237 gal
		Methylene Chloride	75-09-2	20 gal	1 gal	1.6	0.3 gal
		Toluene	108-88-3	5 gal	1 gal	13	4 gal
Medical Facilities, labs, hospitals	742 8062 8069 8071 8063 8072 8063	Benzene	71-43-2	5 gal	0.25 gal	1.6	0.5 gal
		Chloroform	67-66-3	5 gal	0.25 gal	2.3	0.4 gal
		Toluene	108-88-3	5 gal	0.25 gal	13	4 gal
		Carbon Tetrachloride	56-23-5	5 gal	0.25 gal	0.10	0.02 gal
		Isopropyl alcohol	67-63-0	5 gal	0.25 gal	226	77 gal
		Benzadine	92-87-5	5 gal	0.25 gal	*****	*****gal, as 10% soln
Metal Fabrication	3441 3442 3443 3444	Hydrocarbon solvents	8032-32-4	110 gal	5 gal	323	134 gal as TPH
		Tetrachloroethene	127-18-4	20 gal	5 gal	1.6	0.3 gal
		Sodium Hydroxide	1310-73-2	50 lb	5 lb	1603 as Na	892 gal, 50% sol w/v
		Xylene, mixed isomers	1330-20-7	20 gal	1 gal	13	4 gal
		Sodium Cyanide	143-33-9	50 lb	5 lb	65 as Ca	267 lb NaCN
		Hydrochloric acid	7647-01-1	10 gal	1 gal	258 as Cl	201 gal, 35% soln. v
		Sulfuric Acid	7664-93-9	10 gal	1 gal	323 as SO4	46 gal
Paint/auto Body Shops	7532	Methylene chloride	75-09-2	5 gal	1 gal	1.6	0.3 gal
		Xylene, mixed isomers	1330-20-7	20 gal	1 gal	13	4 gal
		Hydrocarbon solvents	8032-32-4	20 gal	5 gal	323	134 gal as TPH
		Ethylene glycol	107-21-1	60 gal	1 gal	258	62 gal

Critical Materials Use Activity List, Critical Materials Expected at Business Locations

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Type of Business	SIC Codes	Possible Critical Material	CAS Number	Amount Expected on Site	Size of Unit	Critical Quantity in kg	Critical Quantity in gal or as noted
Photo Processing Supplies	3861	Silver salts	7440-22-4	1 lb	1 lb	16 as Ag	62 lb as Ag#03
	7333	Sodium thiosulfate	10102-17-7	10 lb	0.5 lb	969 as Na	7321 lb as Na
	7395	Sodium Cyanide	143-33-9	10 lb	0.5 lb	65 as Cn	267 lb NaCN
	5946	Aromatic hydrocarbons		5 gal	1 gal	5.5	2.0 gal as xylene
	7384						
Plastics & Fiberglass; Mfg. & Use	2821	Acetone	67-64-1	200 gal	55 gal.	1292	437 gal
	2822	Methyl ethyl ketone	79-93-1	100 gal	55 gal	646	212 gal
	3041	Styrene	100-41-4	1000 gal	bulk	32	9 gal
	3069	Epoxy resin		1000 gal	bulk		
	3732	Hydrocarbon solvents	8032-32-4	10 gal	1 gal	323	134 gal
	3732	Methylene Chloride	75-09-2	20 gal	1 gal	1.6	0.3 gal
Printing Estblshmnts.	2711	Tetrachloroethene	127-18-4	20 gal	5 gal.	1.6	0.3 gal
	2731	Hydrocarbon solvents	8032-32-4	20 gal	5 gal.	323	134 gal
	2752	Aromatic hydrocarbons	1330-20-7	5 gal	1 gal.	6.5	2.0 gal as xylene
	2761	Silver salts	7440-22-4	1 lb	1 lb	16	62 lb as Ag#03
	2721	Sodium Cyanide	143-33-9	10 lb	1 lb	65 as Cn	267 lb NaCN
	2732						
	2741						
	2759						
	2732						
	2796						
2754							
Radiator repair	7539	Ethylene glycol	107-21-1	120 gal	1 - 55 gal	250	61 gal
		Hydrocarbon solvents	8032-32-4	110 gal	55 gal.	323	134 gal as TPH
		1,1,1-Trichloroethane	71-55-6	50 gal	5 gal	65	13 gal
		Lead (compounds)	7439-92-1	50 gal	5 gal	16 as Pb	3 gal, 50% PbSO4 soln.
		Sodium Hydroxide	1310-73-2	25 lb	25 lb	1683 as Na	892 gal, 50% soln. w/v
Reed Cleaning and Treating	0721	Hexachlorobenzene	118-74-1	50 gal	5 gal	16	35 lbs
Solvent Recycling	2911	Trichloroethene	79-01-6	1,000 gal	55 gal	1.6	0.3 gal
		Tetrachloroethene	127-18-4	1,000 gal	55 gal	1.6	0.3 gal
		1,1,1-Trichloroethane	71-55-6	1,000 gal	55 gal	65	13 gal
		Hydrocarbon solvents	8032-32-4	1,000 gal	55 gal.	323	134 gal as TPH
Trucking Companies	4171	Gasoline	8006-61-9	10,000 gal	10,000	323	118 gal
	4172	Lubricating oil		300 gal	5 gal.	323	118 gal
	4213	Ethylene glycol	107-21-1	120 gal	1 - 55	250	61 gal
		Hydrocarbon solvents	8032-32-4	55 gal	55 gal.	323	134 gal

Code of Business	SIC Codes	Possible Critical Material	CAS Number	Amount Expected on Site	Size of Unit	Critical Quantity in kg	Critical Quantity in gal or as noted
		Caustic soda cleaning solution	1310-73-2	200 gal	tank	1683 as Na	892 gal, 50% soln. w/v
Water softener sales and service	5074	Sodium Bisulfite	7631-90-5	500 lb	25 lb	4376 as Na	2900 gal, 40% soln
		Sodium hydrogen sulfide	16721-80-5	500 lb	25 lb	3114 as Na	6050 lb NaHS
		Sodium Chloride	7647-14-5	5,000 lb	50 lb	1595 as Cl	3500 lb NaCl



Dear (Owner/Operator):

In order to protect the drinking water for the City of Richland, we have an active wellhead protection program in accordance with State requirements. As part of our wellhead protection program we have mapped the area overlying the short-term recharge zone of our drinking water supply wells. This is our wellhead protection area.

You are receiving this letter because your business is located within the boundaries of a wellhead protection area. The enclosed map shows the 1, 5, and 10 year time of travel boundaries for our wellhead protection area. Any ground water contamination that occurs within these wellhead protection areas have a high potential to reach our wells.

We have conducted an inventory of businesses and potential sources for ground water contamination within the areas. Businesses located within the boundaries of a wellhead protection area may have the potential to affect the public drinking water supply.

We have listed businesses that could be **potential** contaminators in our wellhead protection areas and listed them in our wellhead protection plan. The agencies that regulate your type of business/facility will be notified of your presence within our wellhead protection area. You should contact them to help manage your business in a way that will best prevent ground water contamination. We realize you are already careful to protect the environment as you conduct your business. We hope that informing you of your location in our wellhead protection area will result in an increase in precautions to ensure that your activities will not impact our public water supply.

Sincerely,

Richland Water

City of Richland

**WELLHEAD
PROTECTION
AREA**

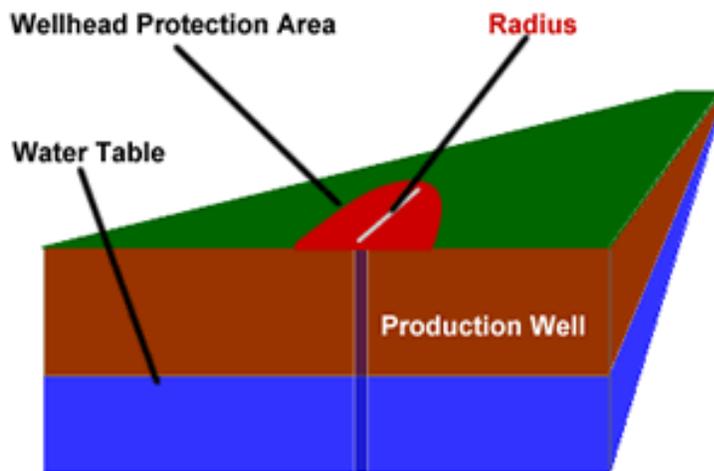
**FOR INFORMATION
CONTACT
RICHLAND WATER
942-7670**

A ground water protection area is a designated surface and subsurface area within approximately a one quarter mile radius surrounding any public water supply well, or well field. Business, industry and residential features (buildings, storage tanks, warehouses, etc...) are inventoried within these areas for potentially hazardous materials that could possibly be susceptible to leaks or spills. The main purpose of this program is to promote the public awareness of the need for the prevention of any dumping of chemicals or other materials, which could eventually lead to the contamination of the ground water supply. This information gathering and signage process is known as a Wellhead Protection Program (WHPP).

Wellhead protection programs are developed to protect public groundwater supplies from contamination, ensure public health, and prevent the need for expensive treatment of groundwater supplies to comply with drinking water standards. The underlying principle of a wellhead protection program is that it is less costly to protect a groundwater supply than to restore water quality after it is compromised

Sources of Ground Water Contamination and Potential Contaminant Transit Routes

Typical Wellhead Protection Area (3 Dimensional Cross-Section)



- Infiltration of polluted surface water
- Land disposal of either solid or liquid wastes
- Unprotected dumps
- Animal feedlots
- Fertilizers and pesticides
- Accidental spills
- Above ground storage tanks
- Septic tanks, cesspools and privies
- Unlined holding ponds and lagoons
- Waste deposal in excavations
- Leakage from underground storage tanks
- Leakage from underground pipelines
- Waste disposal in well excavations
- Well disposal of wastes
- Unprotected exploratory wells
- Abandoned wells