MALCOLM PIRNIE

36-00-18

INTERIM REMEDIAL PROPOSAL

WESTCHESTER COLPROVIA CORPORATION
BEDFORD, NEW YORK

JULY 1990

MALCOLM PIRNIE, INC.

100 Eisenhower Drive
P.O. Box 36
Paramus, New Jersey

2 Corporate Park Drive
P.O. Box 751
White Plains, New York 10602

1074-01-1104

MALCOLM PIRNIE

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1.0 INTRODUCTION

1.1 GENERAL

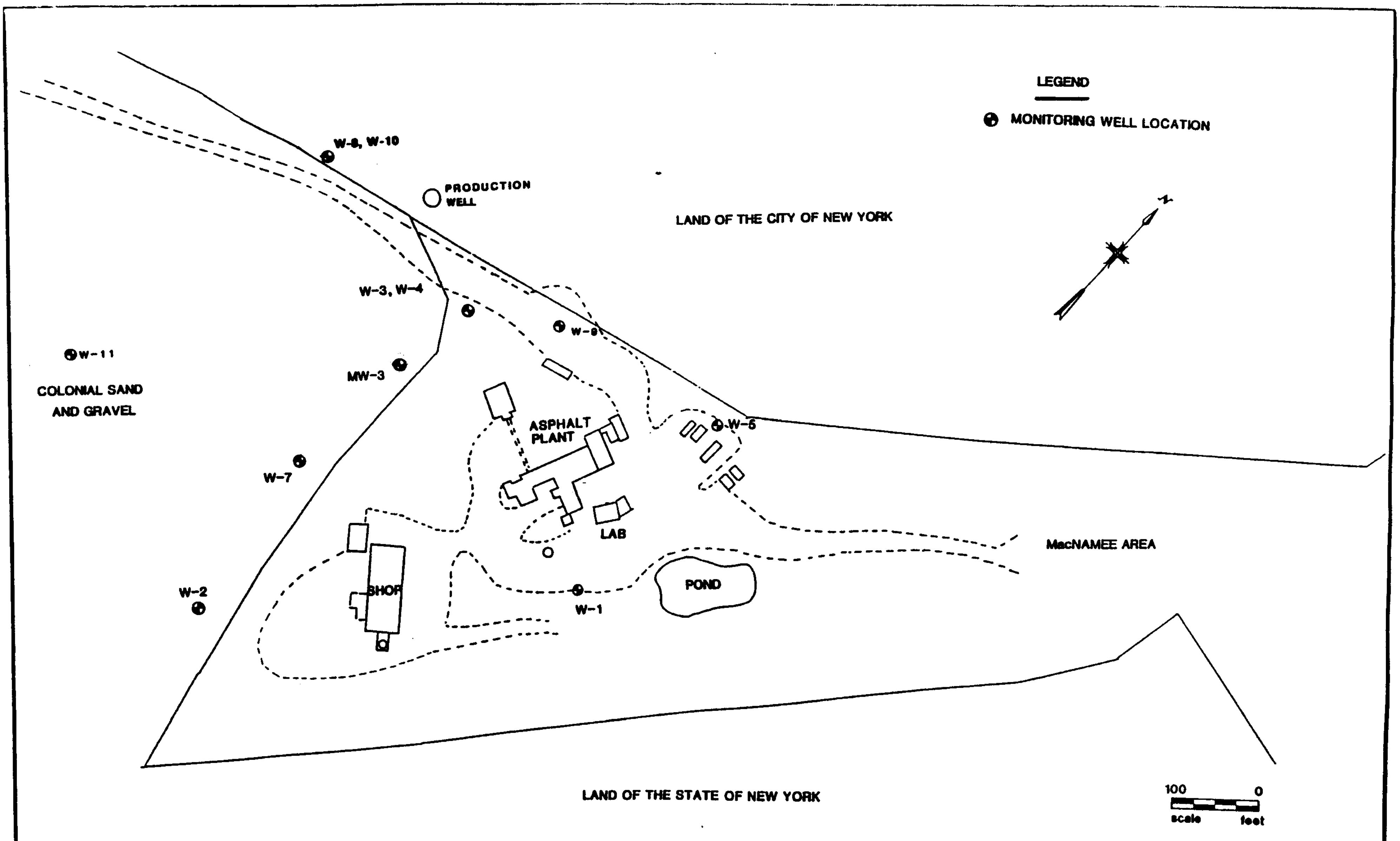
Westchester Colprovia Corporation formerly owned and operated an asphalt production plant in the Town of Bedford, Westchester County, New York. This Facility is currently owned and operated by Peckham Materials. Figure 1-1 provides a site map of the facility. In December 1986 trichloroethylene (TCE) was detected in a monitoring well referred to as MW-3 on the property of Colonial Sand & Gravel, located near the western boundary of the Peckham Materials Property. Earlier work was presented to the New York State Department of Environmental Conservation (NYSDEC) in three reports. The previous reports are discussed below in Section 1.2. The Interim Remedial Proposal was first submitted in July 1988.

Roadways are planned to be constructed on portions of the Colonial property and the Peckham property by New York State Department of Transporation (DOT) and by the municipality. The roadways are discussed below in Section 1.3.

1.2 PREVIOUS REPORTS

1.2.1 Report of Site Investigations - November 23,1987

In November 1987, Malcolm Pirnie, Inc. issued a reported entitled "Report of Site Investigations at Westchester Colprovia Corporation." This report provided the results and interpretation of the Phase I and II ground water investigations, the underground tank investigation, and the soil gas investigation. Soil gas was investigated in July 1987 by Tracer Research Corporation under subcontract to Malcolm Pirnie. The installation of monitoring wells W-1 through W-5, and W-7 through W-9 was documented in this report. At the time of the report it was proposed that ground water be collected and treated for volatile organic compounds (VOCs) in the area of MW-3, and certain soils of concern on Westchester Colprovia property be remediated using a soil gas extraction system. The



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WESTCHESTER COLPROVIA CORPORATION
BEDFORD, NEW YORK
SITE MAP

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FIGURE 1-1

101170

report also proposed additional investigatory work to design the required remedial measures.

1.2.2 Predesign Study Work Plan - December 4, 1987

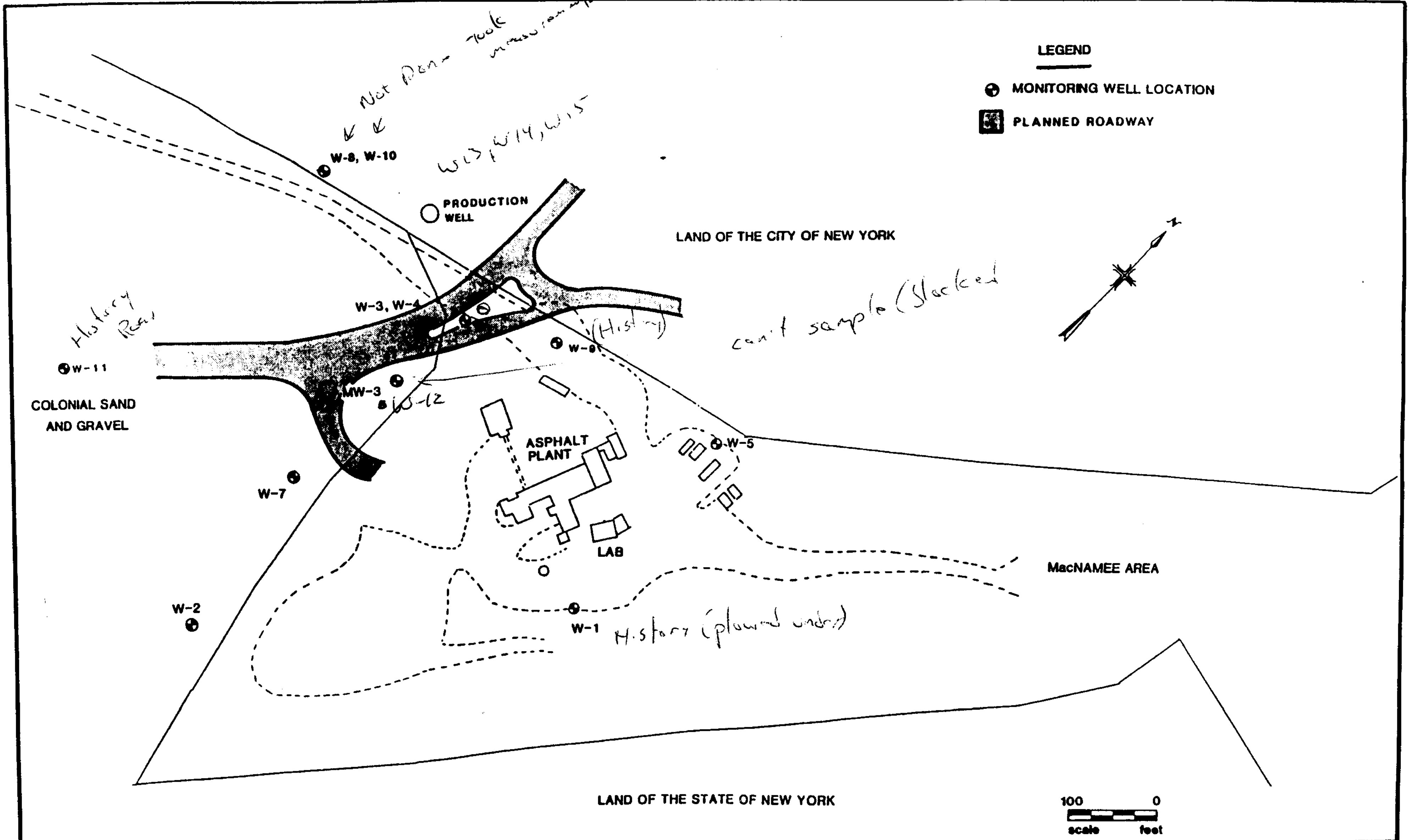
In December 1987 a report entitled "Predesign Study Work Plan" was submitted to the NYSDEC. This report described the additional investigations necessary for the remedial design. Four soil borings/piezometers and a deep monitoring well were proposed in the report. Additional soil samples and ground water samples were to be collected to further define site conditions. The data collected were to be used for locating a ground water recovery system.

1.2.3 Report of Site Investigations - July 26, 1988

This report documented the drilling of five soil borings and two monitoring wells. The wells were designated W-10 and W-11 and were located on Colonial Sand & Gravel Property (see Figure 1-1). Results of aquifer testing, water level measurements, soils analyses, and ground water analyses were presented therein.

1.3 PROPOSED ROADWAYS

Roadways are planned to link Route 117 and the Sawmill River Parkway in the vicinity of the site. Figure 1-2 shows the portions of the road on and near the Peckham Property as derived from New York State Department of Transportation (DOT) drawings. In this area, most of the road will require significant fill to raise the grade. Small areas required to be cut will be to the east of monitoring wells W-3 and W-4 (approximately 3 feet of cut) and where the eastern ramp crosses the property line to the northeast of these wells (approximately 5 feet of cut). About 11 feet of fill is planned at the location of well MW-3 and about 5 feet of fill at the location of W-3 and W-4. This will necessitate extension of the well casings upward so that they may be used after construction of the roads. The DOT is planning to award the contract for the roadway construction late in 1990 with a planned completion date of mid-1993.



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BEDFORD, NEW YORK

PLANNED ROADWAY

FIGURE 1-2

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2.0 PROPOSED REMEDIAL MEASURES

2.1 GROUND WATER RECOVERY

The earlier Interim Remedial Proposal recommended that ground water be collected in the area of MW-3 and treated by air stripping to remove the volatile organics. NYSDEC correspondence of June 19, 1990 indicates that TCE concentrations in this well have fallen seven-fold over the past three years. This monitoring well is located on the property of Colonial Sand & Gravel and had displayed TCE concentrations at about 1500 ppb. New and existing wells need to be analyzed for VOC's to determine the appropriate location to withdraw ground water. Section 3.1.1 below addresses new wells to be installed.

Recovery of contaminated ground water may be accomplished by installation of one or more recovery wells. We believe that flows of 10 gallons per minute (gpm) or more can be developed.

2.2 GROUND WATER TREATMENT

Treatment of ground water for the removal of volatile organics can be effectively accomplished with air stripping. With this remediation technique water is brought into contact with air thereby stripping the volatiles from the water. Two air stripping options are commercially available, countercurrent-flow packed columns and multi-staged diffused aeration systems.

The multi-staged diffused bubble aeration system manufactured by Lowry Engineering, Inc. of Unity, Maine provides similar if not higher removal rates as compared to a packed column. The aeration system has a lower capital cost and maintenance cost as compared to the packed column, and requires less operating space. Appendix A provides literature concerning the multi-staged diffused aeration system from Lowry Engineering, Inc.

The multi-staged diffused aeration system will reduce TCE concentrations in the ground water below the U.S. Environmental Protection Agency (USEPA) drinking water maximum contamination level (MCL) of 5 parts per billion (ppb). Treated ground water will be discharged to a recharge pond to be constructed on the Westchester Colprovia property.

Air leaving the aeration system will contain volatile organics, however the emissions will be quite low. For example, at a flow rate of 20 gpm and a worst-case ground water influent VOC concentration of 1,800 ppb, emissions to the air would be less than 0.02 pounds per hour. Appendix B provides the calculations of emissions. Since the emissions are less than 3.5 pounds per hour, air emissions control equipment is not required by NYSDEC regulations.

Emissions of the individual toxic chemicals were also analyzed to determine if they exceed New York State Air Guideline Concentrations (AGC). This analysis was conducted in accordance with the New York State Department of Environmental Conservation's New York State Air Guide-1, September 1989 (Air Guide-1). Currently the AGCs are under review by NYSDEC. For most of the toxic contaminants listed in Appendix B, a proposal to lower the current AGCs is being considered. Our analyses includes both the proposed AGCs and the current AGCs and show that guidelines would not be exceeded for any toxic contaminants. Calculations are provided in Appendix B.

The treated water will be recharged to the ground. Figure 3-1 provides the location of the pond.

No methylene chloride is expected to be in the ground water extracted for treatment, and therefore, no emissions of methylene chloride to the air will occur. In March 1988, ground water sampling detected methylene chloride in single digit part per billion concentrations in most of the monitoring wells as well as in the field and trip blanks. Prior sampling and analyses of these wells had not detected any methylene chloride. Due to the blank contamination and to the earlier results, the detection of methylene chloride in the wells in the area of proposed ground water extraction has been completely discounted.

2.3 SOIL GAS EXTRACTION

Remediation of volatile contamination of soils in the area of the Westchester Colprovia office and plant can be accomplished by use of a soil gas extraction system. With the soil gas extraction technique, a perforated or slotted pipe is installed as a soil vent and a vacuum is induced by a blower attached to the vent. Air moves through the pore spaces in the vadose zone of the soil and takes the volatile organic compounds with it. The almost complete paving of the Peckham Materials plant and the coarse-grained nature of the soils will tend to increase the effectiveness of this method.

The soil vent is expected to have a radius of influence of at least 50 feet. At a maximum soil gas VOC concentration of 1000 ug/l and a blower flow rate of 200 ft^3/min (cfm), a maximum of 0.75 pounds per hour of VOCs will be emitted to the air initially, which is well below the NYSDEC limit of 3.5 pounds per hour. Average concentrations are expected to be on the order of 50 ug/l which represents an emission rate of 0.0375 pounds per hour. Concentrations are expected to decrease rapidly with time as the amount of VOCs in the soil in this area is estimated to be on the order of 5 to 20 pounds. Appendix B provides the supporting calculations.

An analysis of air emissions was also conducted for soil gas extraction. Both the proposed AGCs and the current AGCs would be met for all the toxic contaminants reviewed even if the highest soil gas values found were continuously extracted. Sample calculations are presented in Appendix B. The compound 1,1,1-trichloroethane was found in the highest concentrations both in the soil gas survey performed by Tracer Research in July 1987 and in the soil sample analyzed during investigative field work conducted January 1988. The "Report of Site Investigation, July 26,1988" provides the details of these activities.

Other VOCs detected in the soil near the office area included trichloroethylene, acetone, 2-butanone, ethylbenzene, and xylenes. Methylene Chloride was not detected in the office area soil but has been detected in soil 100 to 600 feet to the south. Methylene chloride was detected in monitoring well W-5 at 28 ug/l on March 7, 1988. However, methylene chloride contamination was also found in the field and trip blanks at 3 to 5 ug/l. Prior sampling of W-5 by Geraghty & Miller, Inc. in June 1987 did not indicate any methylene chloride.

Tracer Research Corporation reviewed the chromatographs from their July 1987 soil gas investigation. Peaks were identified throughout the site that may be attributed to methylene chloride but this could not be confirmed since no standard for methylene chloride was run during the investigation. The concentrations noted, however, were orders of magnitude less than the three VOCs for which they specifically scanned, namely TCA, TCE, and PCE.

No methylene chloride is expected to be present in the soil gas extraction system emissions. Emissions will be sampled during the first week of operation and analyzed for VOCs.

3.0 REMAINING TASKS

3.1 GROUND WATER RECOVERY SYSTEM

3.1.1 Recovery and Test Wells

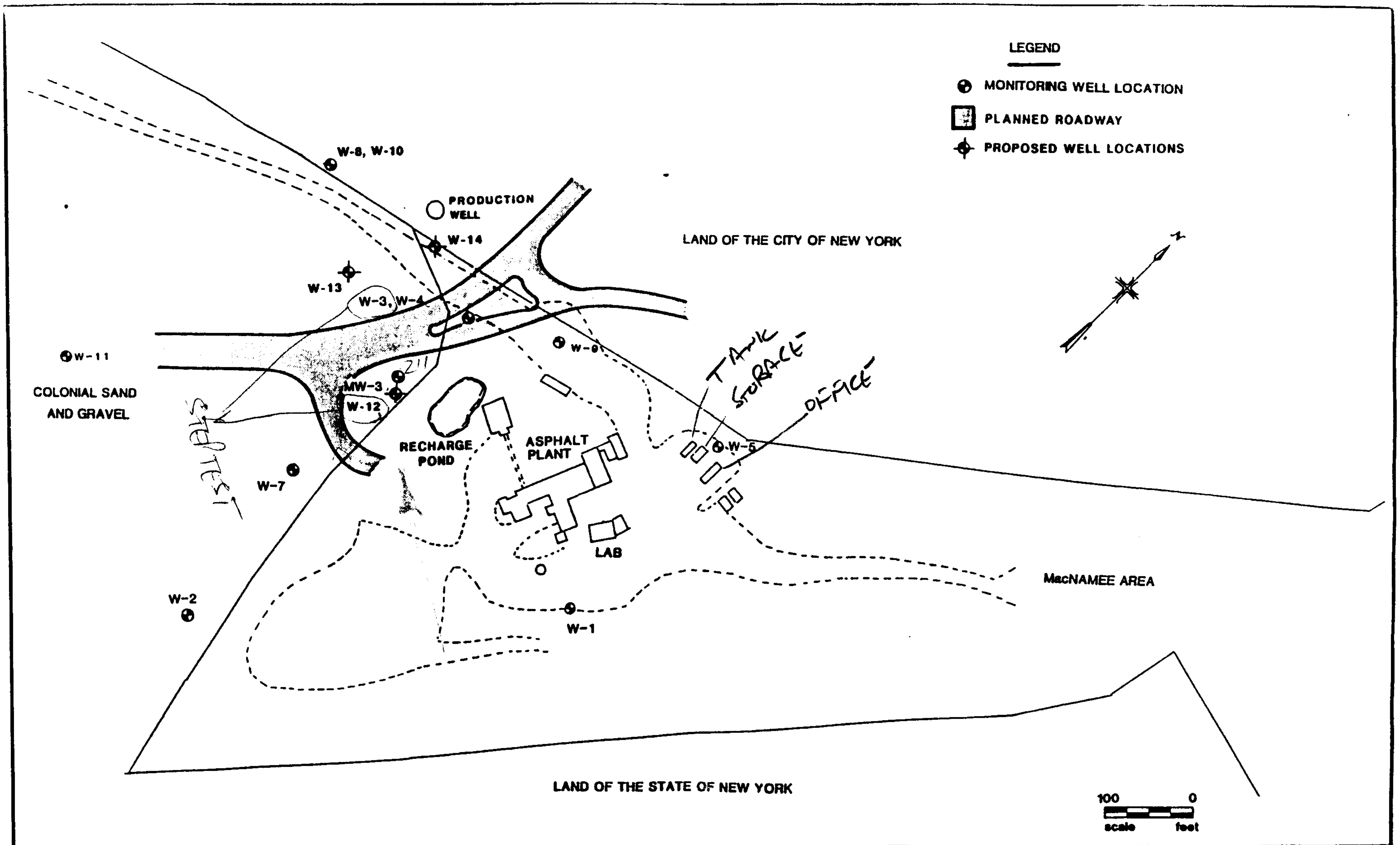
The following system of recovery and test wells has been designed with information collected in previous field studies and may require modification as new data are acquired during implementation of the system. The system proposed has been modified from the earlier plan due to the planned road construction. The system will consist of between three and six wells. The decision to install the extra wells will be made by the field hydrogeologist and will be based on the depth to bedrock and the interval of unscreened aquifer as discussed below.

The new wells are designated W12 through W17 to follow the established numbering system and their locations are shown on Figure 3-1. Well W12 will be installed first near MW3 where the highest TCE levels have been found. Installation of other wells will depend on bedrock depths at W12 and at their locations. Well depths and screened intervals of wells W12 through W16 are outlined in Table 3-1.

Monitoring well W12 will be drilled to bedrock and screened in the bottom 20 feet of the aquifer adjacent to MW3, which is a 2-inch well. It is anticipated that W12 may serve as a recovery well. If the depth to bedrock is greater than 70 feet, monitoring well W15 will be drilled and screened at an intermediate depth between that used in MW3 and W12; otherwise well W15 will not be necessary.

Well W13 will be drilled to bedrock near the toe of the new slope from the planned road and it will be screened in the bottom 20 feet of the aquifer. If the depth to bedrock is greater than the depth to bedrock at W12 and more than 20 feet of aquifer remains unscreened between the elevation of the screen top of W13 and the screen bottom of W12, an additional well, that is W16, will be installed adjacent to W13 at an intermediate depth. Otherwise, well W16 will not be required.

Monitoring well W14 will be drilled to bedrock near Westchester Colprovia's former production well, in the approximate center of off-site ground water flow as determined from ground water contour maps. It



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BEDFORD, NEW YORK

PROPOSED WELL LOCATIONS

FIGURE 3-1

TABLE 3-1

NEW TEST WELLS

Well	Drilled to:	Screened Section will be:
W12	bedrock	20 feet above bedrock to bedrock
W13	bedrock	20 feet above bedrock to bedrock
W14	bedrock	20 feet above bedrock to bedrock
W15*	-	intermediate between W12 and MW3
W16*	-	intermediate between W13 and W12
W17*	-	intermediate between W14 and W12

* To be installed only if more than 20 feet of the aquifer remains unscreened between wells designated.

will be screened in the bottom 20 feet of the aquifer. If the depth to bedrock is greater than depth to bedrock in W12 and more than 20 feet of aquifer remains unscreened between the elevation of the screen top of W14 and the screen bottom of W12, an addition well (W17) will be drilled and screened to an intermediate depth between W14 and W12.

Sampling will be conducted on all newly installed wells and wells W3, W4, W7, and MW3 prior to pump testing the proposed recovery well. Samples will be analyzed for volatile organics. This will provide further data for delineation of the plume.

3.1.2 Pumping Tests

A preliminary step rate pumping test will take place before the constant rate pumping test. The step test consists of a series of equally timed periods with pumping rates being "stepped" up between each time period. The step test will be run for a total of eight hours, with four two-hour steps. Test data collected during the step test will aid in determining the pumping rate for the subsequent constant rate pumping test. Water levels in the surrounding wells will be measured regularly during the step test. This will establish which wells are most affected by the pumping and therefore which should be more closely monitored during the subsequent 72 hour constant rate pump test. All water pumped will be treated (see Section 3.2 below) and discharged to the proposed recharge pond.

Water levels will be intermittently measured before, during, and after the 72-hour pump test in all monitoring wells, and continuously in those wells selected from data collected during the step test. The constant rate pumping test data will be analyzed to determine aquifer transmissivity which is a measure of how easily water moves through the aquifer. Based on the transmissivity value calculated, an optimal contaminant capture zone can be produced through limiting the extent of the cone of depression developed as a result of pumping the recovery well. Water samples for volatile organics will be collected from the discharge line of the pumping well at the beginning of the pumping test, and at 24, 48, and 72 hours. These samples are expected to show how the plume is responding to the pumping test and will also aid in the final design of the collection system.

3.1.3 Percolation Tests

Percolation tests were conducted in the area of the proposed recharge pond on the Peckham Materials property to verify its capacity for recharge of the treated groundwater. The location of the pond is indicated on Figure 3-1. Percolation test data is provided in Appendix C.

3.2 GROUND WATER TREATMENT SYSTEM

3.2.1 Installation

A multi-staged diffused aeration system will be installed to treat water from the recovery well. The system will consist of influent piping and valves, the stripping unit and blowers. The ground water will be pumped from the well through the metering valve and water meter to the entrance of the unit, and be discharged by gravity flow. Air will be forced by blower through a pressure gauge and through the unit's capillary tubes, where it will diffuse through the water and into the atmosphere.

3.2.2 Testing

Field testing will be conducted to verify treatment levels. The rate at which a volatile organic compound is removed from the water by aeration, ie, the mass transfer characteristics of the compound, are dependent upon several factors:

- hydraulic loading rate (water flowrate),
- air flowrate,
- air to water (A:W) ratio,
- ambient temperature of the air and water,
- physical chemistry of the compound.

The latter two factors are constant at any particular time and will not be altered during the tests. The design factors which will be varied during the tests are the water flowrate, air flowrate, and A:W ratio.

Influent and effluent samples will be collected for each run. The air and liquid flowrates, and air and water temperatures will also be measured for each run. Samples will be collected in properly prepared sample vials for VOC analysis.

The results of the aeration tests will be analyzed to confirm expected removal efficiencies, mass transfer relationships and A:W ratio versus blower configuration of the multi-staged diffused bubble aeration system. The data will then be evaluated using a linear regression analysis. A sensitivity analysis of the system performance as a function of influent concentration will be made to check the system's flexibility in handling increased VOC loads.

VOC discharge into the air will be verified once the multi-staged diffused bubble aeration system operating criteria have been established. The quantity of VOCs discharged into the atmosphere is dependent on the influent and effluent VOC concentrations and the water flowrate to be treated. A mass balance will be performed around the treatment unit to determine the quantity of VOCs discharged into the atmosphere. The design of the pumping rate and the influent VOC concentration will be used to establish this mass balance.

3.3 SOIL GAS EXTRACTION SYSTEM

A soil gas vent will be installed in the vicinity of the O&G Colprovia office near well W5, soil boring SBP1, and soil gas sample SG04. This will be a slotted or perforated pipe, and will be installed so that the bottom is below the lowest expected ground water level at this location. A blower will be attached to the vent and testing will be conducted to determine gas flow rates and VOC concentrations in the gas.

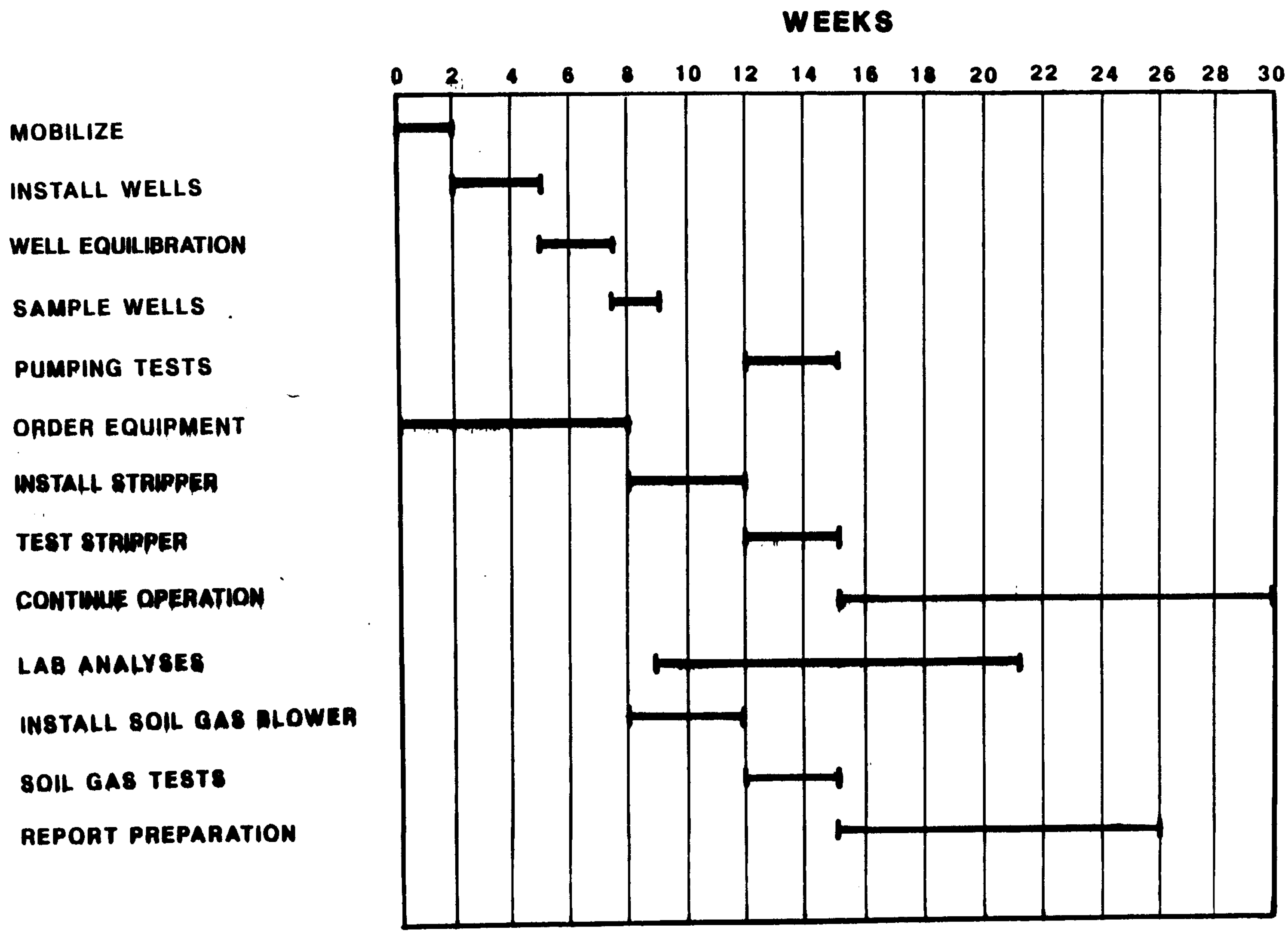
VOC concentrations will be analyzed in the field by portable gas chromatograph (GC). Selected samploes will be verified by a laboratory using gas sample bags or adsorption tubes or a combination of these techniques for sample collection. These concentrations, along with the flow rates, will be used to estimate VOC emission rates and system performance.

3.4 REPORTING

After completion of the above tasks a report will be prepared presenting the information obtained. Monitoring and treatment will continue while the report is being written. This report will provide locations and logs of test wells and results of pumping tests and chemical analyses. Recommendations for pumping rates and final locations of collection and/or monitoring wells will be included. Results of ground water treatment tests will be submitted as well as installation details. Soil extraction flow rates and VOC concentrations will be presented along with recommendations for continuing or stopping of operations. Recommendations for ongoing monitoring will also be presented.

4.0 SCHEDULE

Figure 4-1 presents an estimated schedule for the interim remedial program. The start of the schedule corresponds to receipt of written approval from NYSDEC of the Interim Remedial Proposal. The schedule also assumes completion of certain planning tasks prior to start. These include obtaining permission for access and construction on the Colonial property, selecting a driller for well installation, selecting a contractor for equipment installation, and preparing pre-purchase specifications for equipment.



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WESTCHESTER COLPROVIA CORPORATION

PROJECT SCHEDULE

MALCOLM PIRNIE, INC.

FIGURE 4-1

APPENDIX A

INFORMATION ON AERATION SYSTEM

DESIGN AND APPLICATION GUIDE

FOR

the STRIPPER®

MULTI-STAGED AERATION PRODUCTS

Lowry Engineering, Inc.
P.O. Box 536
Unity, ME 04988

Phone: (207) 948-3790
FAX: (207) 948-2471

the **Stripper**®

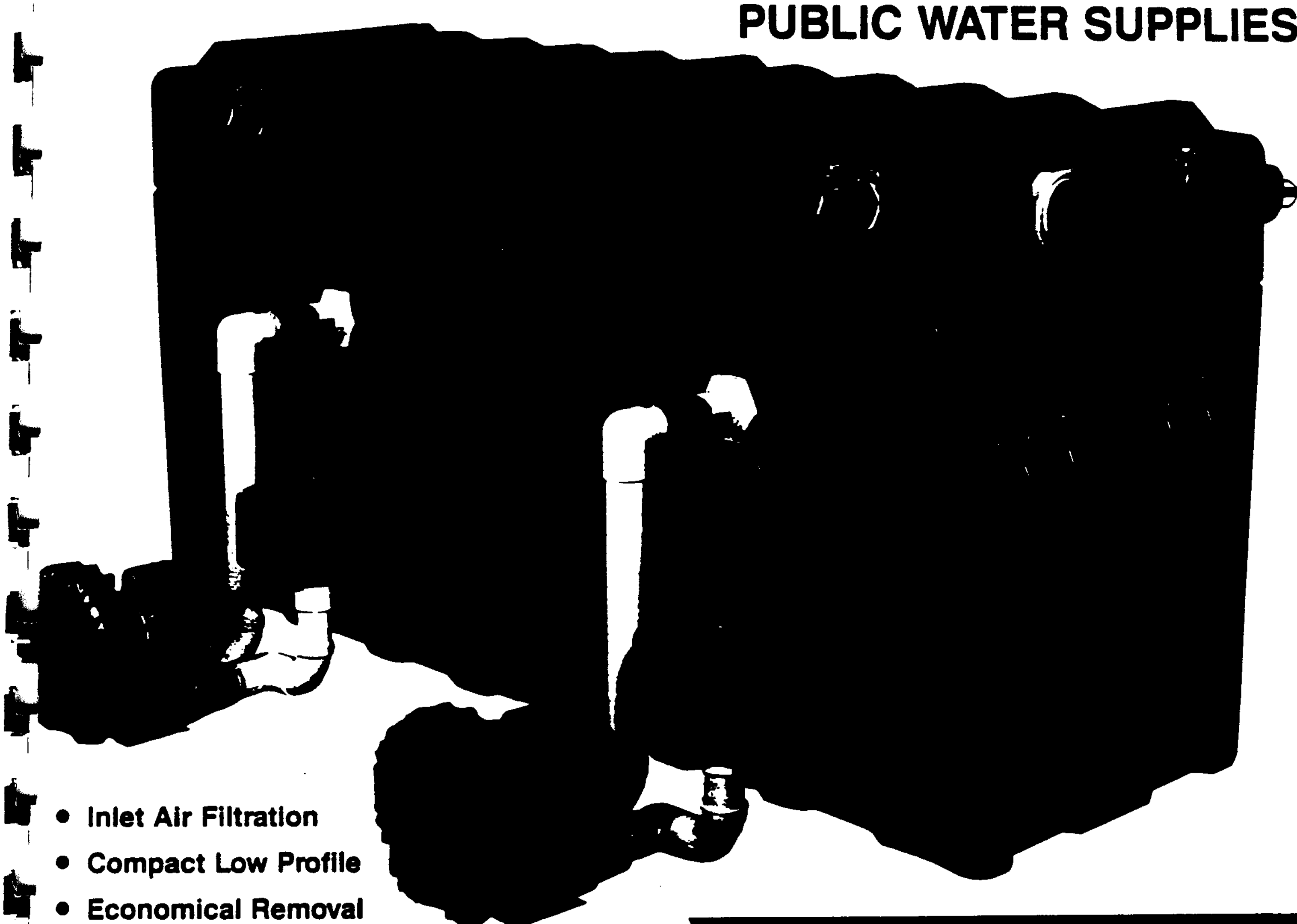
Multi-Staged Diffused Bubble Aeration System
from **Lowry Engineering, Inc.** U.S. Patent No. 4663089

Model PS150

6-Stages

For Public Water Supplies

THE ALTERNATIVE TO PACKED TOWER AERATION FOR PUBLIC WATER SUPPLIES



- **Inlet Air Filtration**
- **Compact Low Profile**
- **Economical Removal**
- **Up To 150 gpm Per Module**
- **Flexible Air To Water Ratio**
- **Ease of Installation And Maintenance**
- **Effective Multi-Staged Process**
- **Modular Design For Multiple Units**
- **Removable Lid For Easy Access**
- **Quiet Reliable Blowers**

Contaminants Removed By Stripper

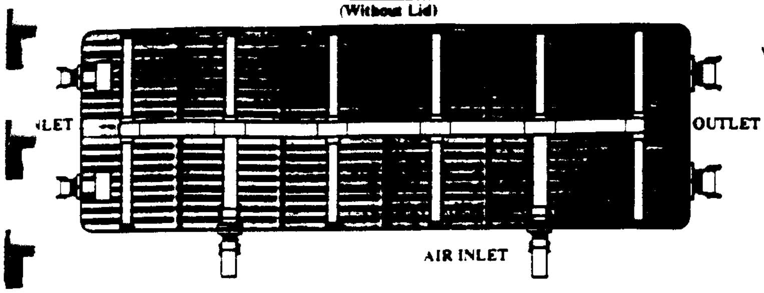
- TCE
- PCE
- Gasoline/BTX
- MTBE
- TCA
- Radon
- Carbon Dioxide
- Hydrogen Sulfide
- EDB
- Other Volatile Contaminants

Design Charts
See Accompanying Sheets For Specific Contaminant

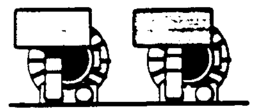
Specifications
Refer to Other Side

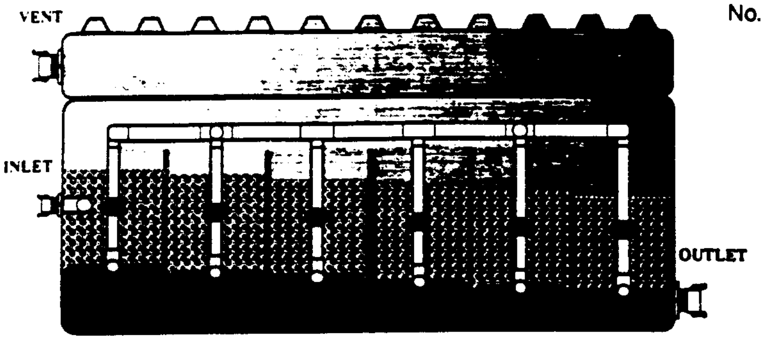
Model PS150 Stripper Multi-Staged Aeration System 6-Stages

TOP VIEW (Without Lid)



REMOTE BLOWER LOCATION





CROSS SECTION DURING AERATION

Vessel Dimensions (outside w/o lid): 84.25 in (L) x 28.25 in (W) x 32.50 in (H)

Vessel Lid Dimensions: 84.25 in (L) x 28.25 in (W) x 9.00 in (H)

Vessel and Lid Construction: Rotationally Molded High Density Polyethylene (NSF & FDA approved) 0.25 in. average thickness (approx). Lid seal is by airtight continuous silicone rubber gasket and stainless steel quarter-turn catches located around the vessel perimeter. Handles are mounted on the vessel to assist in transport and placement.

Shipping Weight (est): 470 lbs with two 1.0 hp blowers

Construction Detail: see drawing

Stages No. and Construction: 6 stages; stainless steel and polyethylene divider plates

Aerator No. and Construction: Aerators, one per stage, fabricated from PVC with a manifold and lateral design. Aerators matched for proper headloss to the blower capacity selected. Air supply manifolds (2.0 in. PVC) are positioned inside along the top of the vessel, above the stage dividers. Each aerator is connected to the supply manifold via a PVC lateral. Aerators attach via female/male threaded connectors for easy removal.

The manifold/aerator assembly is monitored for total backpressure by an air pressure gauge (0-30 in. WC), which can be attached to a quick disconnect fitting on the blower discharge manifold during a routine maintenance check.

Air Blowers: Each Stripper® is supplied with one or multiple regenerative blowers with the following specifications:

Model	hp.	FLA @ 60 Hz. 115/230 volts	cfm @ 17" WC
05	0.5	5.6 - 6.5/3.0 - 3.25	38 - 46
07	0.75	7.9/3.95	66
10	1.0	9.8-12.0/4.9 - 6.0	73 - 84
15	1.5	17.7/8.85	114
20	2.0	17.8/8.90	140

NOTE: Alternative blower sizes and types are available for specific designs.

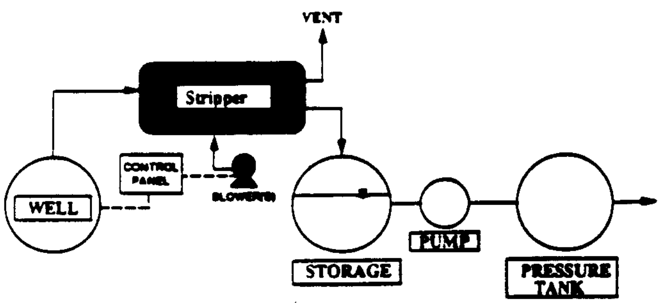
Remote blower location is normal and recommended air piping is specified with each system installation. Integral blower mounting on the vessel lid can be specified. All blowers are equipped with TEFC, class B or F insulated, automatic restart thermally protected single phase motors. Three phase and/or explosion-proof motors can be supplied if specified.

Fittings: All water inlet (1 or 2), water outlet (1 or 2), air inlet, and vent fittings (1 or 2) are comprised of a PVC bulkhead fitting (FPT) in the vessel and a quick disconnect assembly (male/female) for the vent(s) and air inlet manifold. Quick disconnect fittings are optional on the inlet and outlet. The standard nominal sizes of the fittings are:

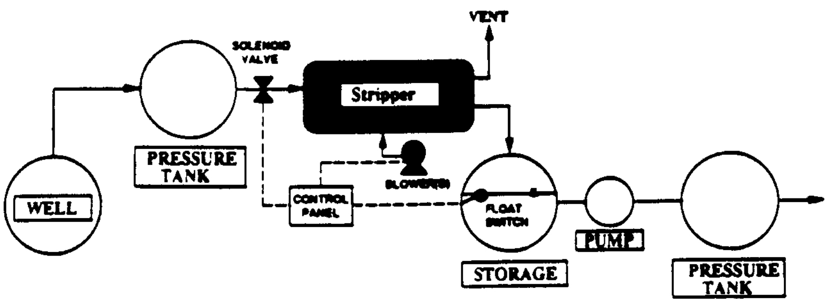
Water Inlet:	2.00 in.
Outlet:	3.00 in.
Air Inlet:	2.00 in.
Vent:	3.00 in.

The internal air manifold is fitted with quick disconnects to allow easy removal.

Typical Stripper® Installation Schematics



GRAVITY FLOW WITH EXISTING STORAGE AND RE-PUMPING



PRESSURE FLOW WITH ADDED ATMOSPHERIC STORAGE AND RE-PUMPING

Lowry Engineering, Inc.
P.O. Box 536, Unity, ME 04988
Tel. (207) 948-3790
FAX (207) 948-2471

the **Stripper**®

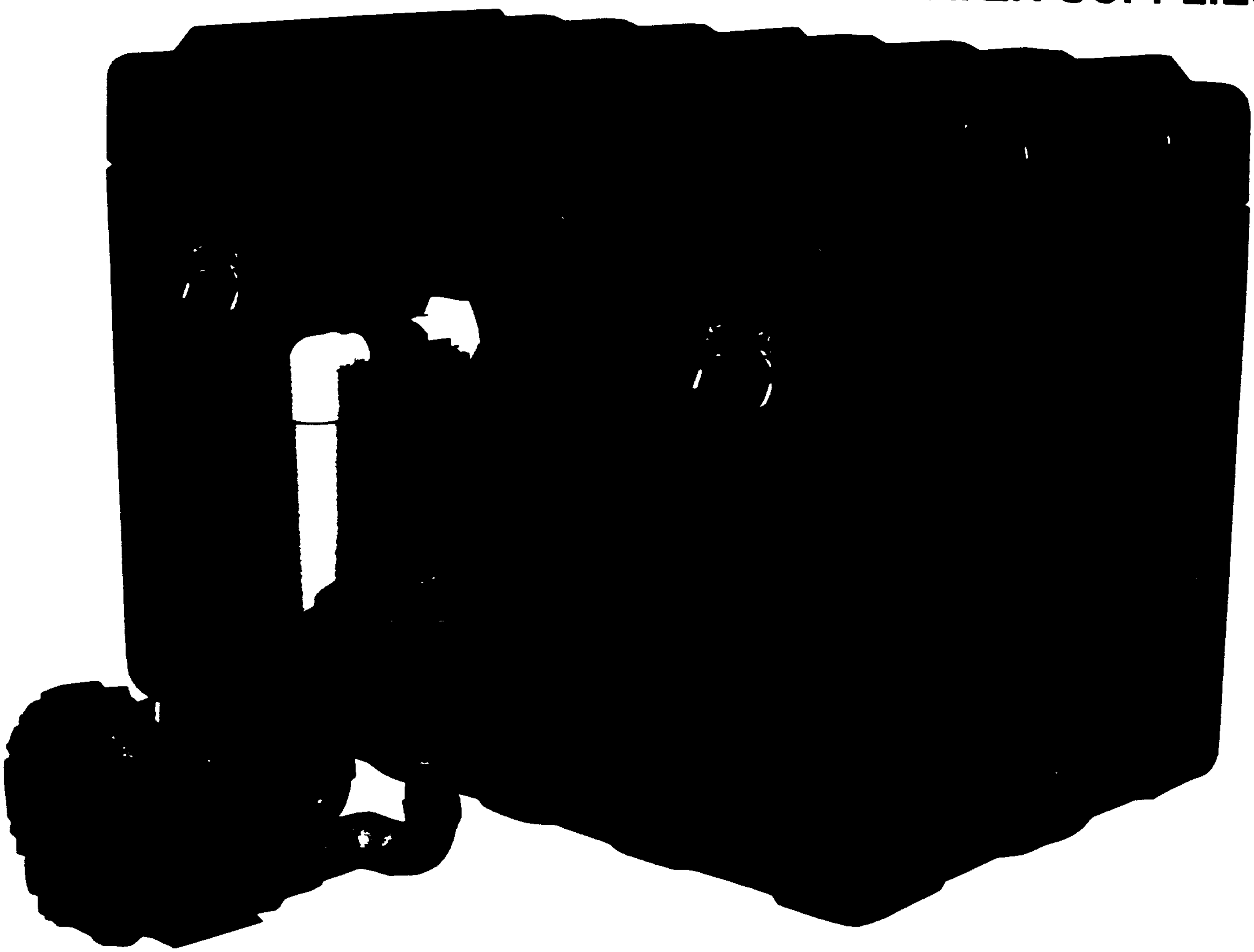
Multi-Staged Diffused Bubble Aeration System
from Lowry Engineering, Inc. U.S. Patent No. 4663089

Model PS100

4-Stages

For Public Water Supplies

THE ALTERNATIVE TO PACKED TOWER AERATION FOR PUBLIC WATER SUPPLIES



- Compact Low Profile
- Economical Removal
- Inlet Air Filtration
- Quiet Reliable Blowers
- Ease of Installation And Maintenance
- Up To 100 gpm Per Module
- Effective Multi-Staged Process
- Flexible Air To Water Ratio
- Modular Design For Multiple Units
- Removable Lid For Easy Access

Contaminants Removed By Stripper®

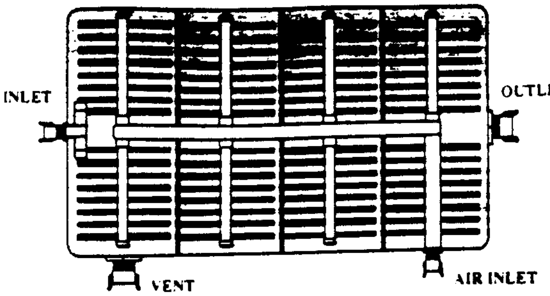
- TCE
- PCE
- Gasoline/BTX
- MTBE
- TCA
- Radon
- Carbon Dioxide
- Hydrogen Sulfide
- EDB
- Other Volatile Contaminants

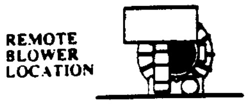
Design Charts
See Accompanying Sheets For Specific Contaminant

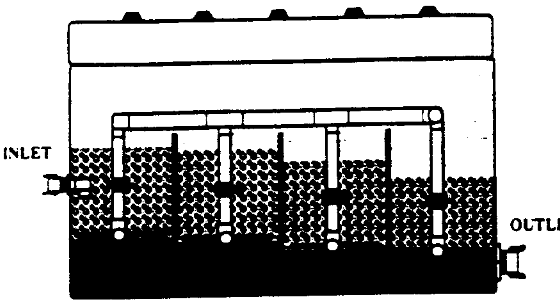
Specifications
Refer to Other Side

Model PS100 Stripper® Multi-Staged Aeration System 4-Stages

TOP VIEW
(Without Lid)







CROSS SECTION DURING AERATION

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Aerator No. and Construction: Aerators, one per stage, fabricated from PVC with a manifold and lateral design. Aerators matched for proper headloss to the blower capacity selected. Air supply manifolds (2.0 in. PVC) are positioned inside along the top of the vessel, above the stage dividers. Each aerator is connected to the supply manifold via a PVC lateral. Aerators attach via female/male threaded connectors for easy removal.

The manifold/aerator assembly is monitored for total backpressure by an air pressure gauge (0-30 in. WC), which can be attached to a quick disconnect fitting on the blower discharge manifold during a routine maintenance check.

Air Blowers: Each Stripper® is supplied with one or multiple regenerative blowers with the following specifications:

Model	hp.	FLA @ 60 Hz. 115/230 volts	cfm @ 17" WC
05	0.5	5.6-6.5/3.0-3.25	38-46
07	0.75	7.9/3.95	66
10	1.0	9.8-12.0/4.9-6.0	73-84
15	1.5	17.7/8.85	114
20	2.0	17.8/8.90	140

NOTE: Alternative blower sizes and types are available for specific designs.

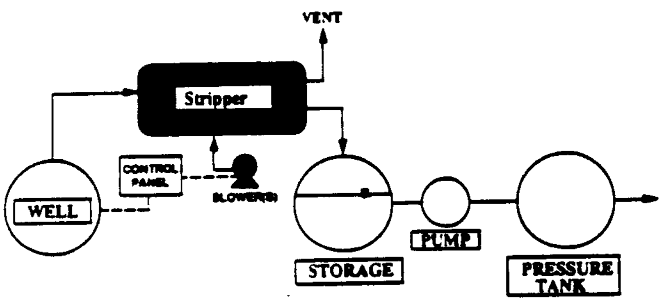
Remote blower location is normal and recommended air piping is specified with each system installation. Integral blower mounting on the vessel lid can be specified. All blowers are equipped with TEFC, class B or F insulated, automatic restart thermally protected single phase motors. Three phase and/or explosion-proof motors can be supplied if specified.

Fittings: All water inlet (1 or 2), water outlet (1 or 2), air inlet, and vent fittings (1 or 2) are comprised of a PVC bulkhead fitting (FPT) in the vessel and a quick disconnect assembly (male/female) for the vent(s) and air inlet manifold. Quick disconnect fittings are optional on the inlet and outlet. The standard nominal sizes of the fittings are:

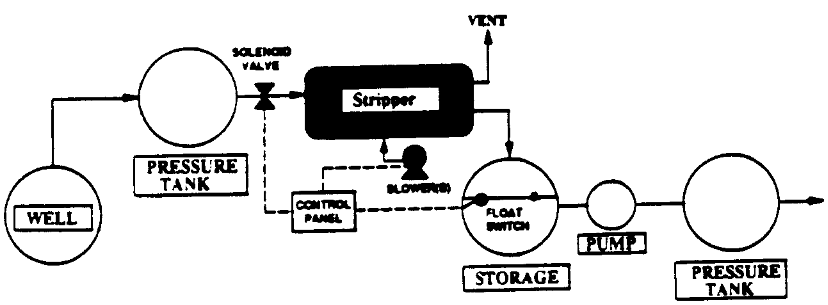
Water Inlet:	2.00 in.
Outlet:	3.00 in.
Air Inlet:	3.00 in.
Vent:	3.00 in.

The internal air manifold is fitted with quick disconnects to allow easy removal.

Typical Stripper® Installation Schematics



GRAVITY FLOW WITH EXISTING STORAGE AND RE-PUMPING



PRESSURE FLOW WITH ADDED ATMOSPHERIC STORAGE AND RE-PUMPING

Lowry Engineering, Inc.
P.O. Box 536, Unity, ME 04988

Tel. (207) 948-3790
FAX (207) 948-2471

the **Stripper**®

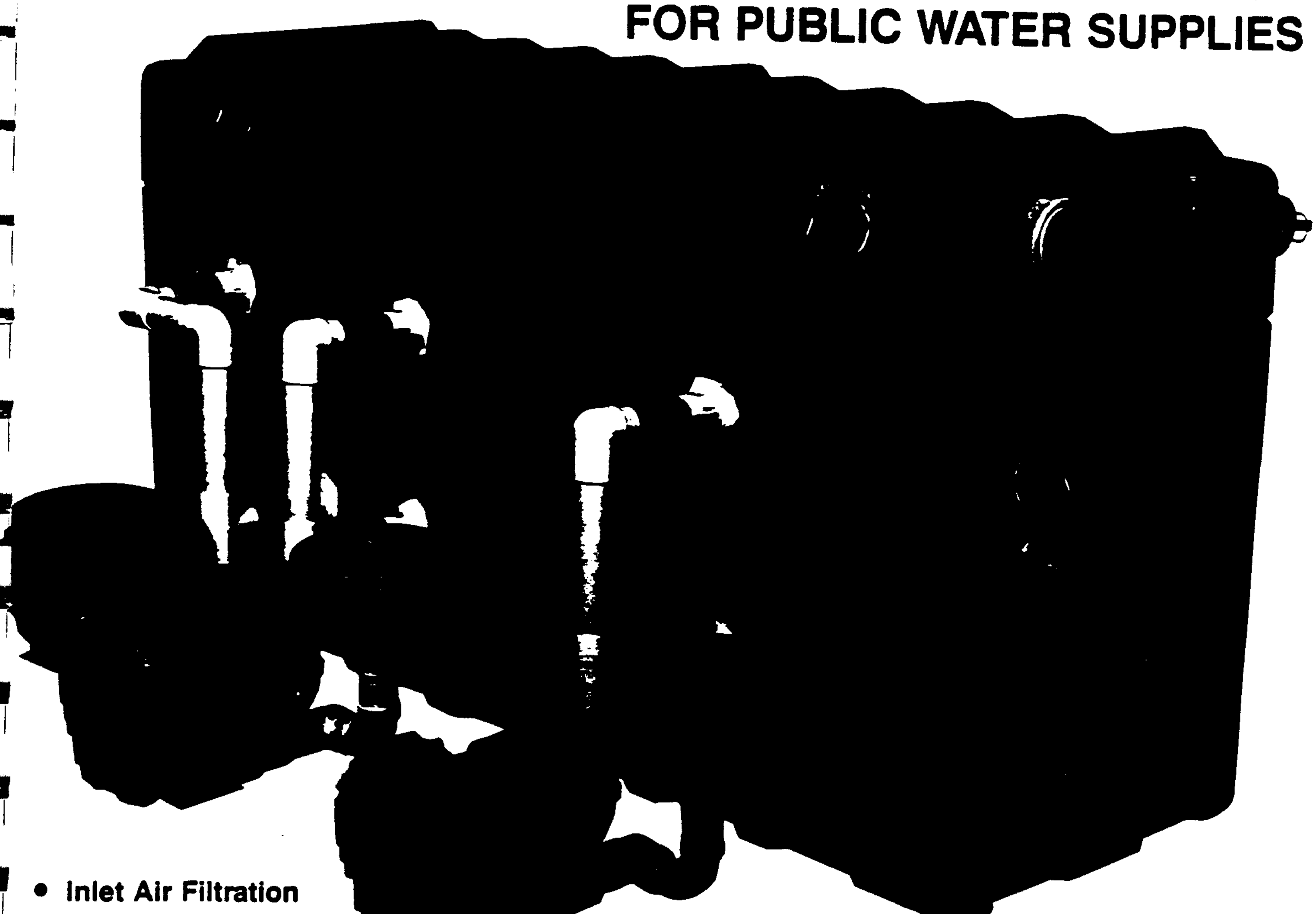
Multi-Staged Diffused Bubble Aeration System
from Lowry Engineering, Inc. U.S. Patent No. 4663089

Model PS80

12-Stages

For Public Water Supplies

THE ALTERNATIVE TO PACKED TOWER AERATION FOR PUBLIC WATER SUPPLIES



- **Inlet Air Filtration**
- **Compact Low Profile**
- **Up To 80 gpm Per Module**
- **Economical Removal**
- **Flexible Air To Water Ratio**
- **Ease of Installation And Maintenance**
- **Effective Multi-Staged Process**
- **Modular Design For Multiple Units**
- **Removable Lid For Easy Access**
- **Quiet Reliable Blowers**

Contaminants Removed By Stripper

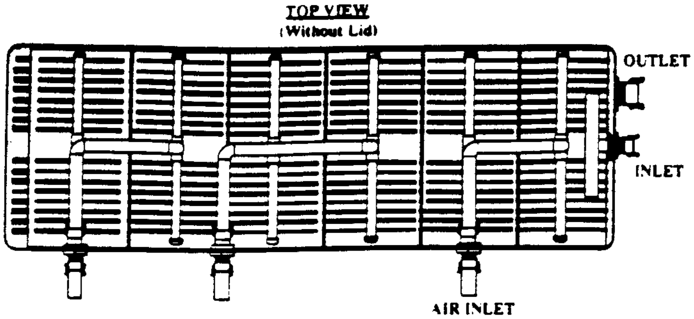
• TCE	• Radon
• PCE	• Carbon Dioxide
• Gasoline/BTX	• Hydrogen Sulfide
• MTBE	• EDB
• TCA	• Other Volatile Contaminants

Design Charts
See Accompanying Sheets For Specific Contaminant

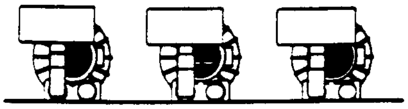
Specifications
Refer to Other Side

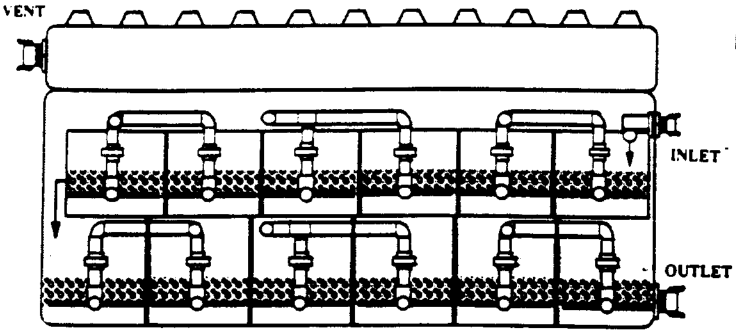
Model PS80 Stripper Multi-Staged Aeration System 12-Stages

TOP VIEW
(Without Lid)



REMOTE BLOWER LOCATION





CROSS SECTION DURING AERATION

Vessel Dimensions (outside w/o lid):	84.25 in (L) x 28.25 in (W) x 32.50 in (H)
Vessel Lid Dimensions:	84.25 in (L) x 28.25 in (W) x 9.00 in (H)
Vessel and Lid Construction:	Rotationally Molded High Density Polyethylene (NSF & FDA approved) 0.25 in. average thickness (approx). Lid seal is by airtight continuous silicone rubber gasket and stainless steel quarter-turn catches located around the vessel perimeter. Handles are mounted on the vessel to assist in transport and placement.
Shipping Weight (est):	595 lbs with three 1.0 hp blowers
Construction Detail:	see drawing
Stages No. and Construction:	12 stages: stainless steel and polyethylene divider plates
Aerator No. and Construction:	Aerators, one per stage, fabricated from PVC with a manifold and lateral design. Aerators matched for proper headloss to the blower capacity selected. Air supply manifolds (1.5 in. PVC) are positioned inside, above the stage dividers. Each aerator is connected to the supply manifold via a PVC lateral. Aerators attach via female/male threaded connectors for easy removal. The manifold/aerator assembly is monitored for total backpressure by an air pressure gauge (0-30 in. WC), which can be attached to a quick disconnect fitting on the blower discharge manifold during a routine maintenance check.

Air Blowers: Each Stripper® is supplied with one or multiple regenerative blowers with the following specifications:

Model	hp.	FLA @ 60 Hz. 115/230 volts	cfm @ 11" WC
07	0.75	7.9/3.95	75
10	1.0	12.0/6.0	90
15	1.5	17.7/8.85	118
20	2.0	17.8/8.90	150

NOTE: Other blower types and sizes are available for specific designs.

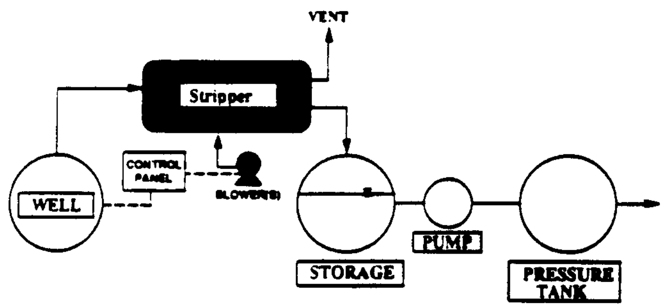
Remote blower location is normal and recommended air piping is specified with each system installation. Integral blower mounting on the vessel lid can be specified. All blowers are equipped with TEFC, class B or F insulated, automatic restart thermally protected single phase motors. Three phase and/or explosion-proof motors can be supplied if specified.

Fittings: All water inlet (1 or 2), water outlet (1 or 2), air inlet, and vent fittings (1 or 2) are comprised of a PVC bulkhead fitting (FPT) in the vessel and a quick disconnect assembly (male/female) for the vent(s) and air inlet manifold. Quick disconnect fittings are optional on the inlet and outlet. The standard nominal sizes of the fittings are:

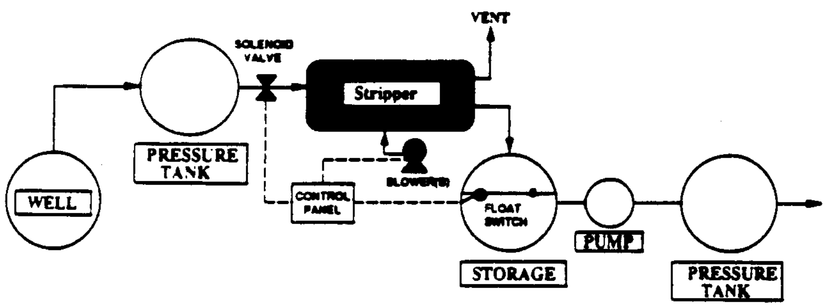
Water Inlet:	2.00 in.
Outlet:	3.00 in.
Air Inlet:	2.00 in.
Vent:	3.00 in.

The internal air manifold is fitted with quick disconnects to allow easy removal.

Typical Stripper® Installation Schematics



GRAVITY FLOW WITH EXISTING STORAGE AND RE-PUMPING



PRESSURE FLOW WITH ADDED ATMOSPHERIC STORAGE AND RE-PUMPING

Lowry Engineering, Inc.
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the Stripper®

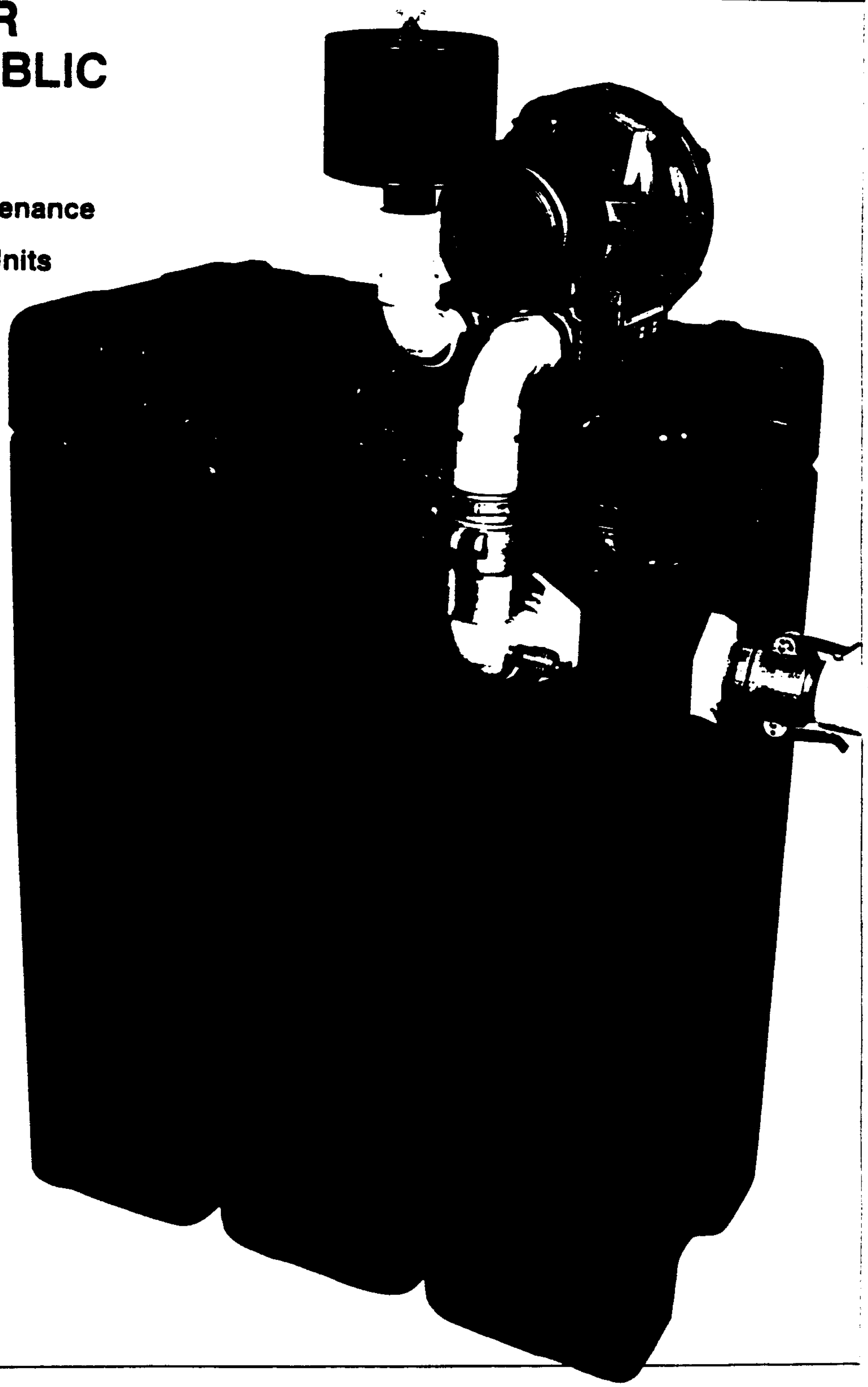
Multi-Staged Diffused Bubble Aeration System
from Lowry Engineering, Inc. U.S. Patent No. 4663089

Model PS25

3-Stages

For Public Water Supplies

THE ALTERNATIVE TO PACKED TOWER AERATION FOR PUBLIC WATER SUPPLIES



- Ease of Installation And Maintenance
- Modular Design For Multiple Units
- Up To 25 gpm Per Module
- Effective Multi-Staged Process
- Flexible Air To Water Ratio
- Removable Lid For Easy Access
- Compact Low Profile
- Inlet Air Filtration
- Economical Removal
- Quiet Reliable Blowers

Contaminants Removed By Stripper®

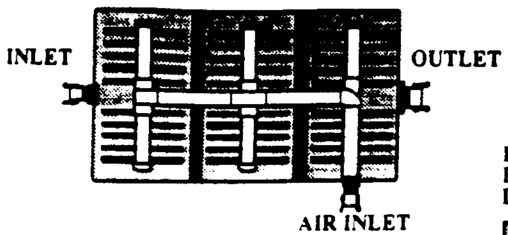
- TCE
- PCE
- Gasoline/BTX
- MTBE
- TCA
- Radon
- Carbon Dioxide
- Hydrogen Sulfide
- EDB
- Other Volatile Contaminants

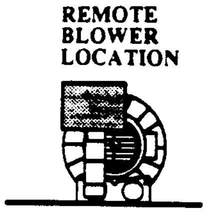
Design Charts
See Accompanying Sheets For Specific Contaminant

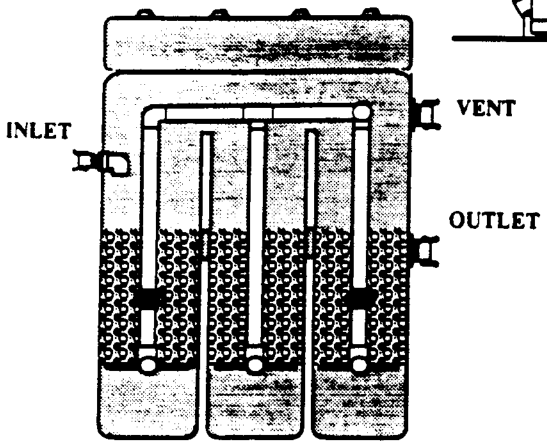
Specifications
Refer to Other Side

Model PS25 Stripper® Multi-Staged Aeration System 3-Stages

TOP VIEW
(Without Lid)







CROSS SECTION DURING AERATION

Vessel Dimensions (outside w/o lid): 32 in (L) x 17.5 in (W) x 37.50 in (H)

Vessel Lid Dimensions: 32 in (L) x 17.5 in (W) x 6.0 in (H)

Vessel and Lid Construction: Rotationally Molded High Density Polyethylene (NSF & FDA approved) 0.25 in. average thickness (approx). Lid seal is by airtight continuous silicone rubber gasket and stainless steel quarter-turn catches located around the vessel perimeter.

Shipping Weight (est): 140 lbs with one 0.5 hp blower

Construction Detail: see drawing

Stages No. and Construction: 3 stages; integral molded polyethylene stage dividers, with bulkhead fittings at a height of 19 in.

Aerator No. and Construction: Aerators, one per stage, fabricated from PVC with a manifold and lateral design. Aerators matched for proper headloss to the blower capacity selected. Air supply manifold (1.5 in. PVC) is positioned inside along the top of the vessel, above the stage dividers. Each aerator is connected to the supply manifold via a PVC lateral. Aerators attach via female/male threaded connectors for easy removal.

The manifold/aerator assembly is monitored for total backpressure by an air pressure gauge (0-30 in. WC), which can be attached to a quick disconnect fitting on the blower discharge manifold during a routine maintenance check.

Air Blowers: Each Stripper® is supplied with an integral regenerative blower with the following specifications:

Model	hp.	FLA @ 60 Hz. 115/208-230 volts	cfm@16-18"WC
03	0.33	3.8/1.9	28 - 34
05	0.05	5.6 - 6.5/2.8 - 3.3	38 - 48

NOTE: Other blower types and sizes are available for specific applications.

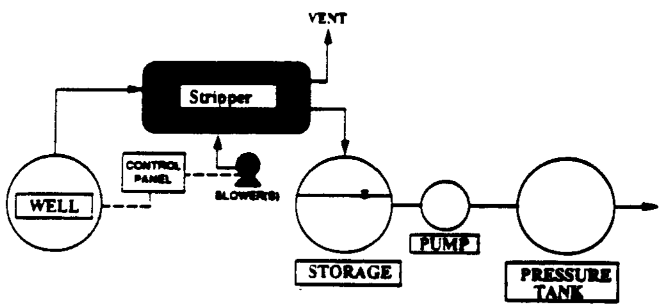
Remote blower location is normal and recommended air piping is specified with each system installation. Integral blower mounting on the vessel lid can be specified. All blowers are equipped with TEFC, class B or F insulated, automatic restart thermally protected single phase motors. Three phase and/or explosion-proof motors can be supplied if specified.

Fittings: All water inlet (1), water outlet (1), air inlet (1), and vent (1) fittings are comprised of a PVC bulkhead fitting (FPT) in the vessel and a quick disconnect assembly (male/female) for the vent and air inlet. Quick disconnect fittings are optional on the inlet and outlet. The standard nominal sizes of the fittings are:

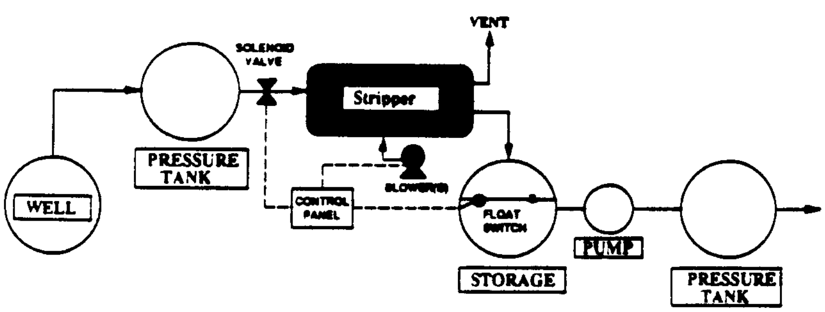
Water Inlet:	1.50 in.
Outlet:	3.00 in.
Air Inlet:	1.50 in.
Vent:	2.00 in.

The internal air manifold is fitted with quick disconnects to allow easy removal.

Typical Stripper® Installation Schematics



GRAVITY FLOW WITH EXISTING STORAGE AND RE-PUMPING



PRESSURE FLOW WITH ADDED ATMOSPHERIC STORAGE AND RE-PUMPING

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AIR/WATER

The air/water ratio is a unitless term used to relate the air and water flow to stripper performance. It is the volume of air divided by the volume of water, and the general equation given below can be used for the various Stripper® blower combinations. In the equation, air flow is in cfm and water flow is in gpm.

GENERAL EQUATION:

$$A/W = \frac{\text{Total Blower cfm} \times 7.48}{\text{Water Flow, gpm}}$$

The capacity of the blower or combination of blowers can be obtained from the PS Model spec sheets (backside). When considering multiple blowers, it is suggested that the total number of blowers per module be limited to three (3). In the case of multiple modules in parallel, larger capacity blowers are recommended. Custom manifolds can easily be constructed on-site to accomodate many different blower combinations.

DESIGN CURVES

The accompanying design curves are based upon field and/or pilot data. The data in the performance curves are representative of our best knowledge to date for Stripper®'s equipped with a midrange air input. In field performance we have noted that the Stripper®has equalled or exceeded the performance indicated by these curves. However, there are small variations in performance across the wide range of A/W possible for any given application. Therefore, we **suggest that the design value for water flow be increased by 10 percent to be conservative in the use of the design curves.**

Engineers at LEI are available to assist in the configuration of Stripper® Models for specific installations and performance criteria. Call us with your questions.

OTHER VOC's

As field and pilot data become available, we will add more curves for VOC's not covered by the curves in this guide. In the meantime, the existing curves, along with practical knowledge and information about relative Henry's constants, can be used to get an approximate (conservative) idea of Stripper® performance. Some common compounds are listed below, along with the appropriate curve to use as a design guide.

Contaminant	To Estimate Performance:
BTEX	Benzene normally controls in these applications due to its higher solubility and lower Henry's constant. Toluene is only slightly easier to strip, with xylenes and ethylbenzene being slightly easier still. Therefore, the benzene application curve can be used for a conservative estimate of Stripper® performance.
Vinyl Chloride	Vinyl chloride (VC) is easier to strip than Rn. Use the Rn curve to get a conservative estimate of Stripper® performance.
1,1,1-Trichloroethane	TCA is slightly more easily stripped than TCE. Therefore, use the TCE curve to get a conservative estimate of Stripper® performance.
Carbon Tetrachloride	Carbon tetrachloride is slightly more easily stripped than PCE. Therefore, use the PCE curve to get a conservative estimate of Stripper® performance.
Chlorobenzene Cis-1,2-Dichlorobenzene Trans-1,2-Dichloroethylene	These VOC's are similar to benzene in stripping applications. Therefore, use the benzene curve to get an estimate of Stripper® performance.
1,4-Dichlorobenzene 1,3-Dichlorobenzene Methylene Chloride	These VOC's are between MTBE and benzene in ease of stripping. The MTBE curve can be used to get an idea of Stripper® performance; however, it may be too conservative. An estimate can be obtained by taking the average of the A/W values obtained from the MTBE and benzene curves.
1,2-Dichloroethane 1,2-Dichlorobenzene 1,2,4-Trichlorobenzene	These are very difficult to strip VOC's, similar to MTBE in ease of stripping. Therefore, use the MTBE curve to get an estimate of Stripper® performance.
Hydrogen Sulfide	H_2S has a Henry's constant approximately equal to that of TCE. Therefore, use the TCE design curve to get an estimate of the Stripper® performance.

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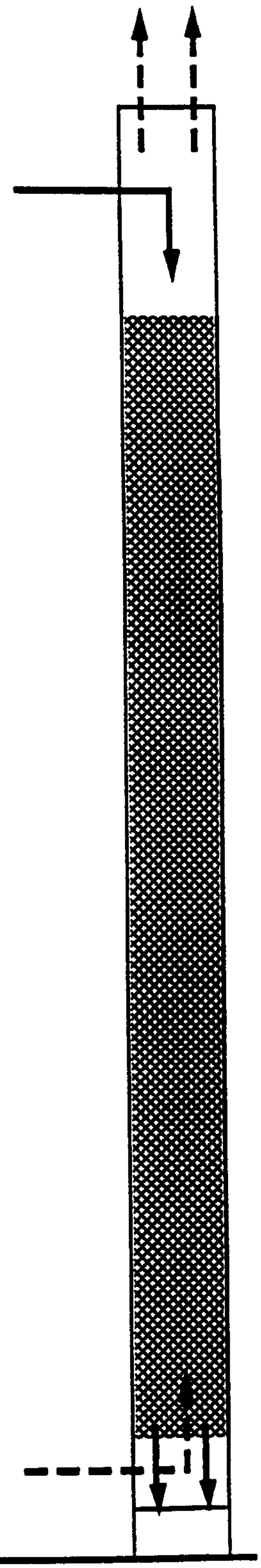
LEI # Stripper v. Packed Tower 10/89

the **Stripper®** multi-staged diffused bubble aeration system is designed to be a preferred alternative to packed tower aeration for small public water supplies, industrial wastewater applications, and ground water pump and treat applications. The key words are "small supplies" or "low flow" applications, because for higher flows a packed tower has the advantage. The definition of "low flow" depends upon the contaminant being removed and the degree of removal required. It ranges from a maximum of approximately 40 gpm for difficult to strip contaminants such as MTBE, to over 600 gpm for easily stripped contaminants such as radon. Below these flows, the Stripper® offers significant performance, cost, and other advantages over a traditional packed tower.



the **Stripper®** was conceived and designed particularly for the small water supply or low flow application. The compact design allows it to be installed in existing buildings without the obvious appearance of a tall stack high in the air. Most importantly, the Stripper® has been designed for ease of maintenance, without the need for an ancillary acid cleaning system as required for the packing in towers. To inspect a Stripper, one simply quarter-turns the catches by hand and lifts the lid which has two handles to allow for easy positioning. If a Stripper vessel ever needs cleaning, it can be easily isolated from service and acid or detergent cleaned. Aerators can be easily removed by hand and replaced in minutes. Aerator maintenance is minimal and is required only when iron and/or manganese or calcium carbonate precipitation occurs. Any maintenance is easily accomplished by one individual at ground level. Aeration in general, whether by packed tower or diffused bubble, requires the removal of iron/manganese to avoid increased maintenance over the long term. When iron/manganese levels are very low there is usually no problem.

Better Performance is another important reason to select the Stripper over a packed tower. Packed towers are limited in their performance by packing height. Even at A/W's above the non-limiting value, a packed tower needs a specific height to achieve removal. The Stripper® is not dependent upon packing height or detention time, but only on the A/W. Any level of removal can be achieved, even at the physical limit of air input into a Stripper® module, by simply decreasing the water flow until the desired A/W is reached.

Relatively tall towers are necessary to achieve high contaminant removals, even for easily stripped contaminants like radon. Removals that approach 99 percent or greater require very tall towers, or multiple towers in series for difficult to strip contaminants such as MTBE. Up to approximately 600 gpm, the Stripper® can achieve virtually any removal by treating the water flow that produces the A/W required for the controlling contaminants.

In Summary, the Stripper® has a real advantage for small water supplies and low flow applications up to 600+ gpm, depending upon the contaminant being removed. Packed towers are best suited to flows above these levels, and are generally not as effective for small supplies and low flow applications, especially where a high degree of removal is required.

Refer to the APPLICATION GUIDE SHEET for the proper use of the DESIGN CURVES

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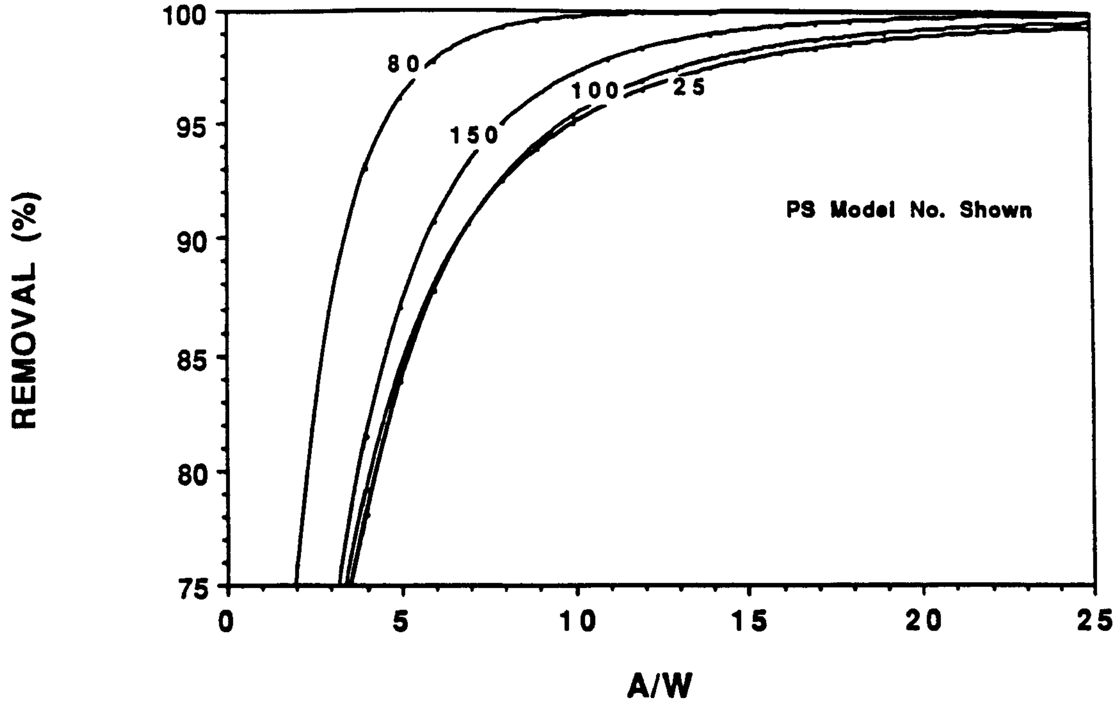
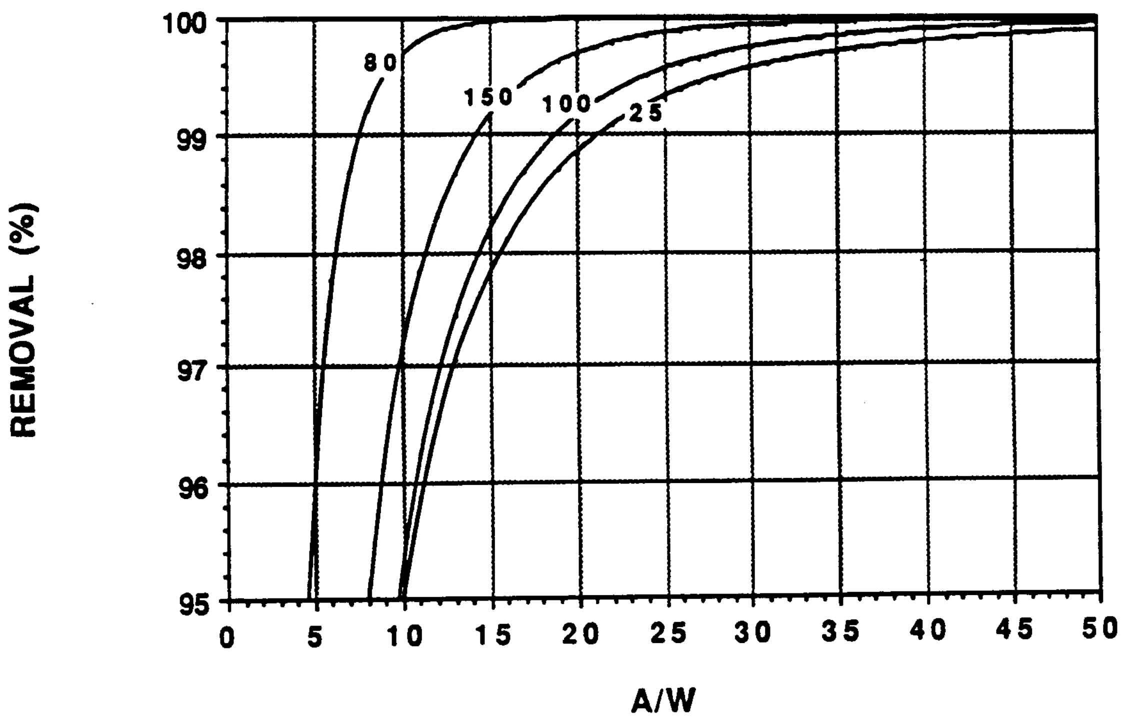
LEI # Stripper DESIGN CHART 10/89

RADON — RADON — RADON



EXPANDED SCALE



Refer to the APPLICATION GUIDE SHEET for the proper use of these DESIGN CURVES

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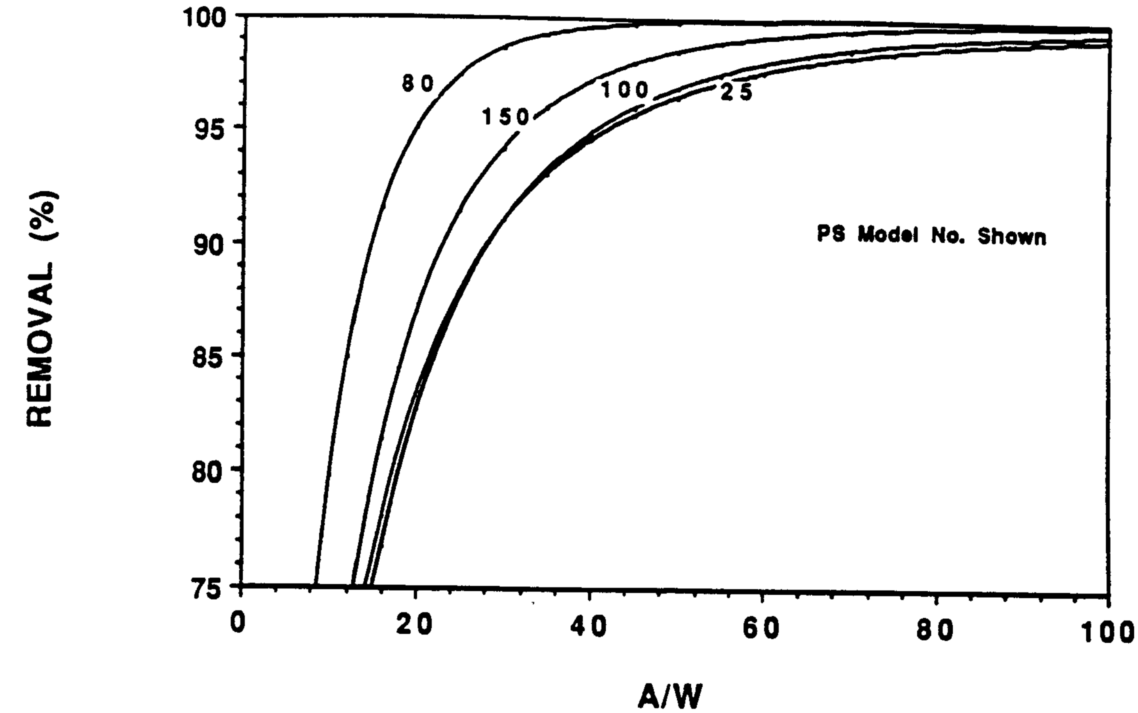
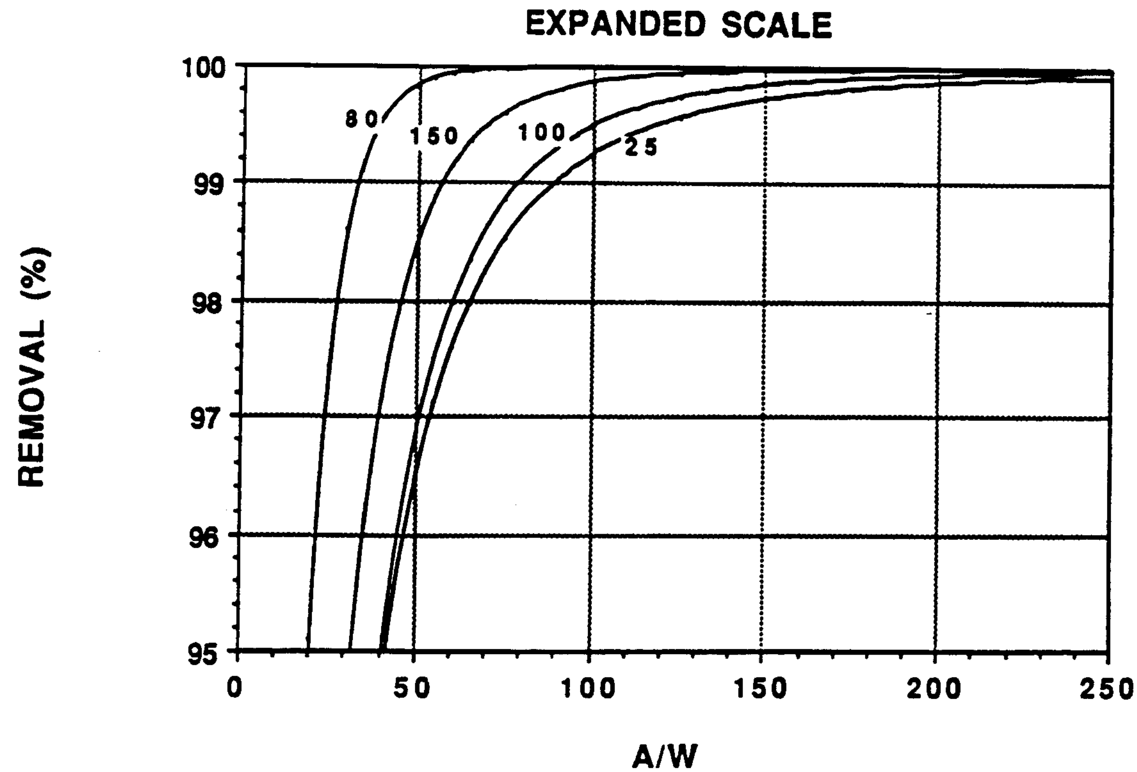
LEI Stripper DESIGN CHART 10/89

PCE — PCE — PCE





Refer to the APPLICATION GUIDE SHEET for the proper use of these DESIGN CURVES

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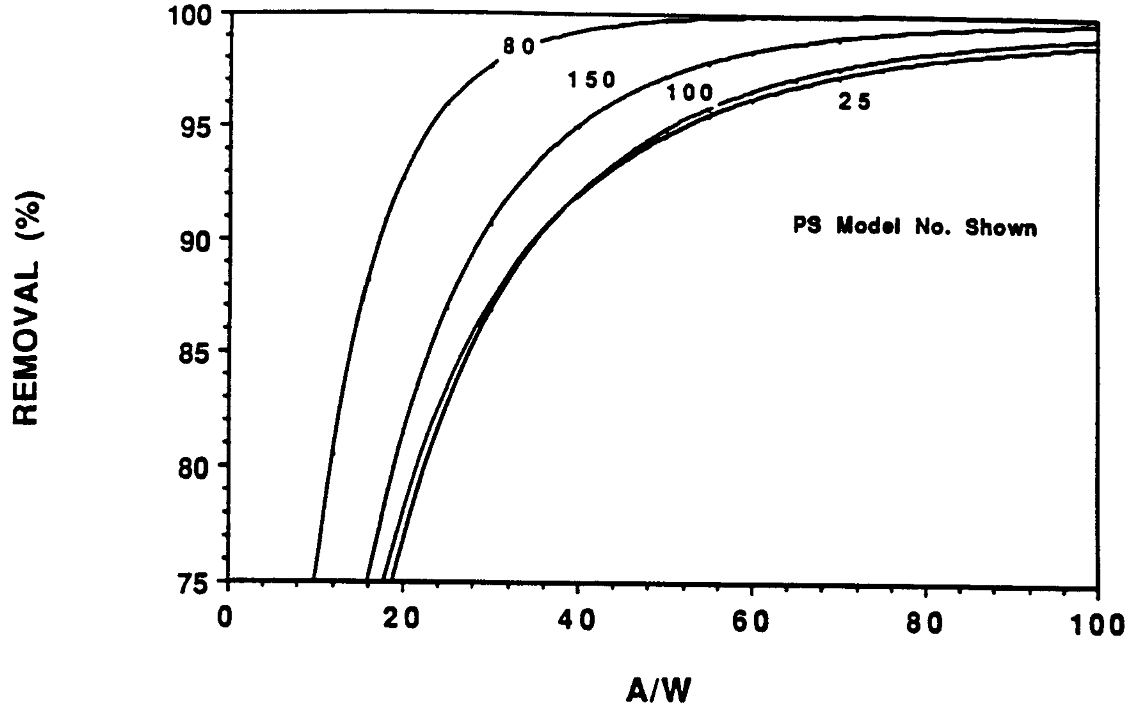
LEI **Stripper DESIGN CHART** 10/89

TCE — TCE — TCE



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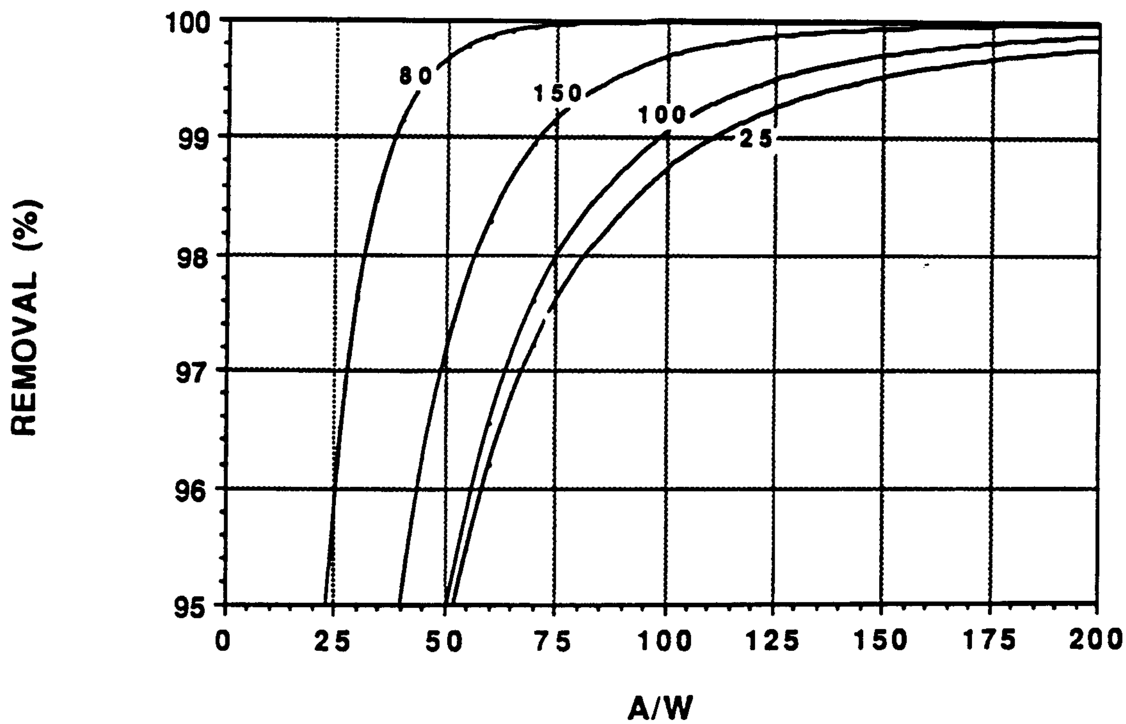

Refer to the APPLICATION GUIDE SHEET for the proper use of these DESIGN CURVES

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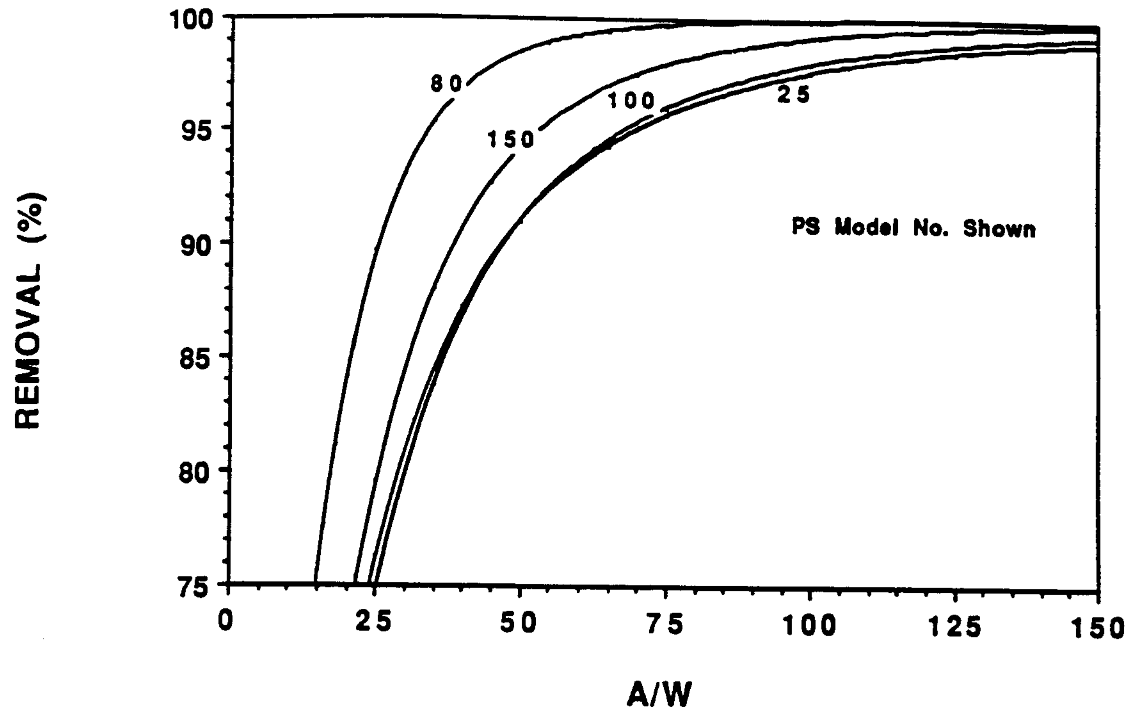
LEI **Stripper DESIGN CHART** 10/89

BENZENE — BENZENE — BENZENE



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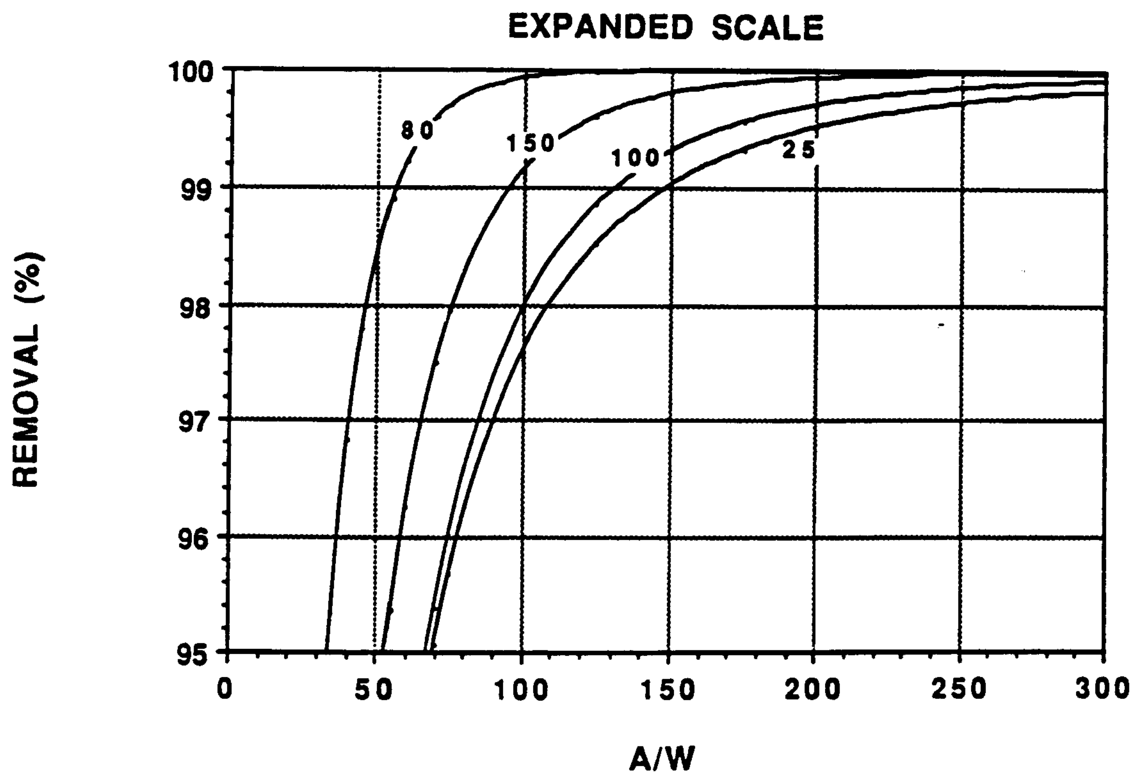

Refer to the APPLICATION GUIDE SHEET for the proper use of these DESIGN CURVES

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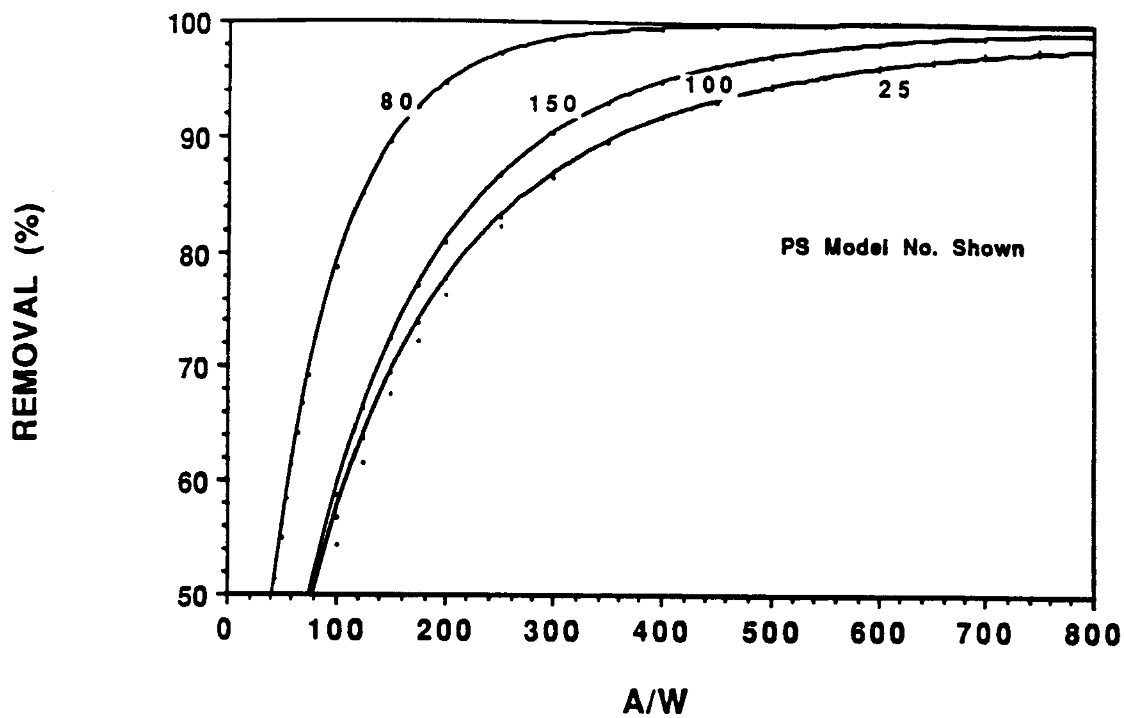
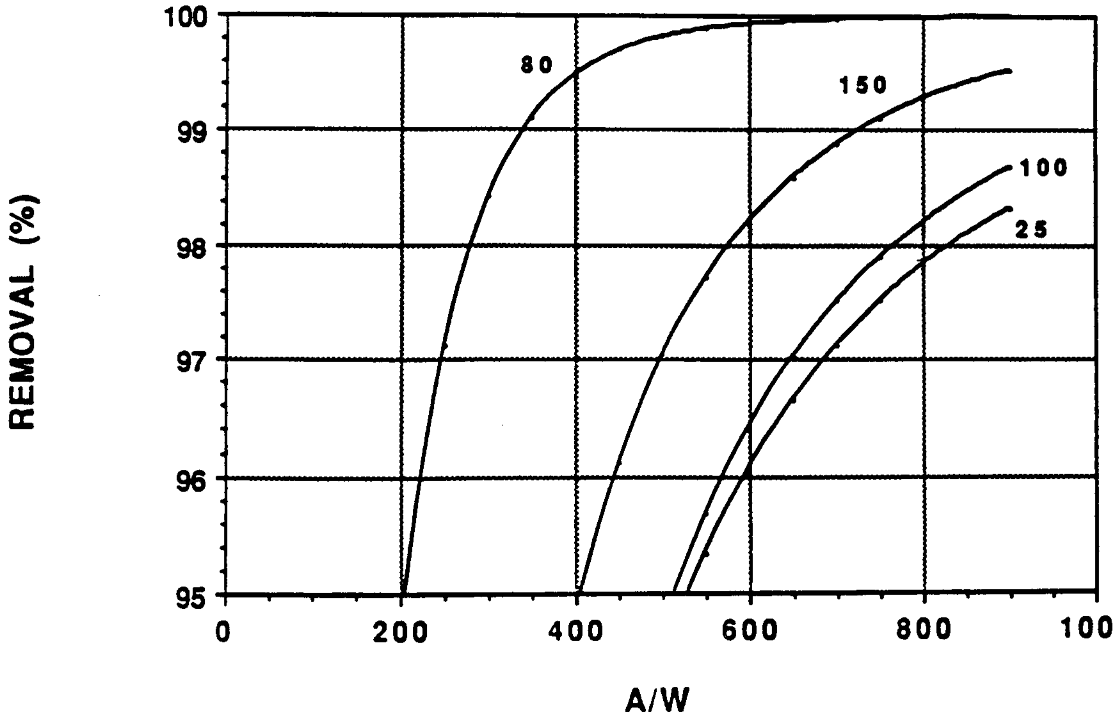
LEI Stripper DESIGN CHART

10/89

MTBE — MTBE — MTBE



EXPANDED SCALE



Refer to the APPLICATION GUIDE SHEET for the proper use of these DESIGN CURVES

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APPENDIX B

CALCULATIONS OF AIR EMISSIONS AND SCREENING ANALYSES

GROUND WATER TREATMENT
AIR STRIPPING EMISSIONS

Assumptions:
1) Water Flow Rate = 20 GPM
2) 100% removal of VOC's in stripper
3) Highest concentrations found are used for calculations

VOC	ug/l	lbs/day @ 20 GPM
1,1,1 TCA	6.2	0.0015
TCE	1,570	0.38
Benzene	13	0.0031
PCE	11	0.0026
Ethylbenzene	6.9	0.0016
Xylenes	15	0.0036
2-hexanone	11	0.0026
trans,1,2 DCE	200	0.048
	1,833	0.44

Sample Calculation

Benzene (pounds per = $\frac{13\ ug}{l} \cdot \frac{1}{0.2642\ gal} \cdot \frac{gm}{1,000,000} \cdot \frac{28,800\ gal}{day} \cdot \frac{lb}{453.59\ gm}$

= 0.0031 lbs/day

SOIL GAS EXTRACTION
AIR EMISSIONS

Assumptions:

1) Maximum Soil Gas VOC Concentration = 1000 ug/l. This is based on Tracer Research investigation data in the trailer area under relatively stable conditions. (See Malcolm Pirnie Report of Site Investigations, November 13, 1987).

2) Air Flow Rate = 200 cfm

<u>Sample Calculation for Initial Highest Rate</u>

$$1000\ \text{ug/l} = 1\ \text{mg/l} = 1000\ \text{mg/m}^3$$

$$\left(200\ \frac{\text{ft}^3}{\text{min}}\quad \frac{60\ \text{min}}{\text{hr}}\quad \frac{0.02832\ \text{m}^3}{\text{ft}^3}\right. = 340\ \text{m}^3/\text{hr}$$

$$\frac{1000\ \text{mg}}{\text{m}^3}\quad \frac{340\ \text{m}^3}{\text{hr}}\quad \frac{\text{gm}}{1000\ \text{mg}}\quad \frac{\text{lb}}{453.59\ \text{gm}} = 0.75\ \frac{\text{lbs}}{\text{hr}}$$

<u>Sample Calculation for Average Rate</u>

$$50\ \text{ug/l} = 0.0.5\ \text{mg/l} = 50\ \text{mg/m}^3$$

$$\frac{200\ \text{ft}^3}{\text{min}}\quad \frac{60\ \text{min}}{\text{hr}}\quad \frac{0.02832\ \text{m}^3}{\text{ft}^3} = 340\ \text{m}^3/\text{hr}$$

$$\frac{50\ \text{mg}}{\text{m}^3}\quad \frac{340\ \text{m}^3}{\text{hr}}\quad \frac{\text{gm}}{1000\ \text{mg}}\quad \frac{\text{lb}}{456.59\ \text{gm}} = 0.0375\ \text{lbs/hr}$$

WESTCHESTER COLPROVIA
SCREENING ANALYSIS
WATER TREATMENT

CHEMICAL	EMISSIONS (lbs/hr)	1 SCREENING RESULTS 1st	2 SCREENING RESULTS 2nd	3 AGC	4 PROPOSED AGC	MEETS GUIDELINE CONC. ?
1,1,1 TCA	6.250E-05	1.24		38000	45238	YES
TCE	1.580E-02	315	1.49E-01	900	0.45	YES
BENZENE	1.291E-04	2.57	6.90E-05	100	0.12	YES
PCE	1.083E-04	2.16	2.40E-03	1116	0.075	YES
ETHYLBENZENE	6.660E-05	1.33		1450	1036	YES
XYLENES	1.500E-04	2.99		1450	1036	YES
2-HEXANONE	1.083E-04			*	*	
trans, 1,2 DCE	2.000E-03	2.16		*	360	YES
TOTAL	1.842E-02					

NOTE: (ALL CONCENTRATIONS LISTED ARE IN MICROGRAMS PER CUBIC METER UNLESS NOTED OTHERWISE.)

* = NOT LISTED IN NEW YORK STATE AIR GUIDE.
1 = IN STACK CONCENTRATION DIVIDED BY ONE HUNDRED. IF LESS THAN PROPOSED AGC THEN 2nd SCREENING WAS NOT NECESSARY.
2 = WORST CASE ANNUAL GROUND CONCENTRATION ACCORDING TO NY STATE AIR GUIDE CALCULATIONS. AIR GUIDE-1, SEPT 1989.
3 = AMBIENT GUIDELINE CONCENTRATIONS FROM NY STATE AIR GUIDE-1, SEPT 1989.
4 = PROPOSED AGC CHANGES IN THE NY STATE AIR GUIDE-1, SEPT 1989.

CONCLUSION: AIR EMISSIONS CONTROL EQUIPMENT IS NOT REQUIRED FOR THESE EMISSIONS.

FILE: A:WCSCREEN.WK1
1074-01-1104
31-Jul-90

FLOW RATE = 200 ft3/min × .0283 m3/ft3

= 200/60 × .0283

= 0.09433 m3/sec

WESTCHESTER COLPROVIA
SCREENING ANALYSIS
SOIL GAS

CHEMICAL	EMISSIONS (lbs/hr)	1 SCREENING RESULTS 1st	2 SCREENING RESULTS 2nd	3 AGC	4 PROPOSED AGC	MEETS GUIDELINE CONC. ?
1,1,1 TCA	2.323E+00	31000		38000	45238	YES
TCE	2.770E-01	3700	1.49E-01	900	0.45	YES
PCE	4.490E-03	60	2.40E-03	1116	0.075	YES
TOTAL	2.604E+00					

NOTE: (ALL CONCENTRATIONS LISTED ARE IN MICROGRAMS PER CUBIC METER UNLESS NOTED OTHERWISE.)

1 = IN STACK CONCENTRATION DIVIDED BY ONE HUNDRED. IF LESS THAN PROPOSED AGC THEN 2nd SCREENING WAS NOT NECESSARY.

2 = WORST CASE ANNUAL GROUND CONCENTRATION ACCORDING TO NY STATE AIR GUIDE CALCULATIONS. AIR GUIDE-1, SEPT 1989.

3 = AMBIENT GUIDELINE CONCENTRATIONS FROM NY STATE AIR GUIDE-1, SEPT 1989.

4 = PROPOSED AGC CHANGES IN THE NY STATE AIR GUIDE-1, SEPT 1989.

CONCLUSION: AIR EMISSIONS CONTROL EQUIPMENT IS NOT REQUIRED FOR THESE EMISSIONS.

FILE: A:SGSCREEN.WK1
1074-01-1104
31-Jul-90

LBS/HR × 0.126 = gm/sec

= 2.323 × 0.126 = 0.292698 gm/sec

Concentration in gm/m3 = EMISSION RATES IN gm/sec / AIR FLOW RATE IN m3/sec

= 0.292698 / 0.09433 × 10^6 microgm/m3

= 3,102,805

= 3,100,000 / 100

= 31,000

APPENDIX C

PERCOLATION TEST DATA

PERCOLATION TEST DATA SHEET

DATE: 5-10-89

LOCATION: Colprovia

ENGINEER: T. Smith

DEPTH OF PERK TESTS: 4' (12" hole)

HOLE NO.	RUN NO.	CLOCK TIME START	CLOCK TIME STOP	ELAPSED TIME (MIN)	DEPTH TO WATER FROM SURFACE START (INCHES)	DEPTH TO WATER FROM SURFACE STOP (INCHES)	TOTAL WATER DROP (IN)	SOIL RATE (MIN/IN)	in/min
1	1	2:31	2:41	10	1½	6½	5	2.0	0.5
	2	2:42	2:52	10	1½	6½	5	2.0	0.5
	3	2:53	3:03	10	2	7	5	2.0	0.5
	4								
	5								

NOTES:

HOLE NO.	RUN NO.	CLOCK TIME START	CLOCK TIME STOP	ELAPSED TIME (MIN)	DEPTH TO WATER FROM SURFACE START (INCHES)	DEPTH TO WATER FROM SURFACE STOP (INCHES)	TOTAL WATER DROP (IN)	SOIL RATE (MIN/IN)	in/min
2	1	2:43	2:53	10	4½	9	4½	2.2	0.45
	2	2:55	3:05	10	2	7	5	2.0	0.5
	3	3:05	3:15	10	2	7	5	2.0	0.5
	4	3:17	3:27	10	2	7	5	2.0	0.5
	5								

NOTES:

PERCOLATION TEST DATA SHEET

DATE: 5-10-89

LOCATION: Glennia

ENGINEER: T. Smith

DEPTH OF PERK TESTS: 4' (12" hole)

HOLE NO.	RUN NO.	CLOCK TIME START	CLOCK TIME STOP	ELAPSED TIME (MIN)	DEPTH TO WATER FROM SURFACE START (INCHES)	DEPTH TO WATER FROM SURFACE STOP (INCHES)	TOTAL WATER DROP (IN)	SOIL RATE (MIN/IN)	in/min
3	1	3:03	3:13	10	3½	10½	7	1.43	0.7
	2	3:14	3:24	10	2½	9½	7	1.43	0.7
	3	3:25	3:35	10	2½	9½	7	1.43	0.7
	4								
	5								

NOTES:

4	1	3:09	3:19	10	3	10½	7½	1.34	0.75
	2	3:20	3:30	10	3	9½	6½	1.54	0.65
	3	3:31	3:41	10	2½	9½	7	1.43	0.7
	4	3:42	3:52	10	2½	9½	7	1.43	0.7
	5	3:53	4:03	10	2	9	7	1.43	0.7

NOTES:

PERCOLATION TEST DATA SHEET

DATE: 5-10-89

LOCATION: Colonia

ENGINEER: T. Smith

DEPTH OF PERK TESTS: 4' (12" hole)

HOLE NO.	RUN NO.	CLOCK TIME START	CLOCK TIME STOP	ELAPSED TIME (MIN)	DEPTH TO WATER FROM SURFACE (INCHES) START	DEPTH TO WATER FROM SURFACE (INCHES) STOP	TOTAL WATER DROP (IN)	SOIL RATE (MIN/IN)	in/min
5	1	3:33	3:43	10	2	7½	5½	1.8	0.55
	2	3:44	3:54	10	2	5	3	3.3	0.3
	3	3:55	4:05	10	3	6	3	3.3	0.3
	4	4:05	4:15	10	3	5	2	5.0	0.2
	5	4:16	4:26	10	3	5	2	5.0	0.2
NOTES:		4:26	4:36	10	3	5	2	5.0	0.2

HOLE NO.	RUN NO.	CLOCK TIME START	CLOCK TIME STOP	ELAPSED TIME (MIN)	DEPTH TO WATER START	DEPTH TO WATER STOP	TOTAL WATER DROP (IN)	SOIL RATE (MIN/IN)	in/min
6	1	3:34	3:44	10	2	7½	5½	1.8	0.55
	2	3:45	3:55	10	2	6	4	2.5	0.4
	3	3:55	4:05	10	2	6½	4½	2.2	0.45
	4	4:05	4:15	10	2	6	4	2.5	0.4
	5	4:16	4:26	10	2	6	4	2.5	0.4
NOTES:		4:26	4:36	10	2	6	4	2.5	0.4

PERCOLATION TEST DATA SHEET

DATE: 5-10-89

LOCATION: California

ENGINEER: T. Smith

DEPTH OF PERK TESTS: 4' (12" hole)

HOLE NO.	RUN NO.	CLOCK TIME START	CLOCK TIME STOP	ELAPSED TIME (MIN)	DEPTH TO WATER FROM SURFACE (INCHES) START	DEPTH TO WATER FROM SURFACE (INCHES) STOP	TOTAL WATER DROP (IN)	SOIL RATE (MIN/IN)	in/min
7	1	3:58	4:08	10	2 1/2	9 1/2	7	1.4	0.7
	2	4:09	4:19	10	3	9	6	1.6	0.6
	3	4:19	4:29	10	3	8	5	2.0	0.5
	4	4:29	4:39	10	3	8	5	2.0	0.5
	5	4:39	4:49	10	3	8	5	2.0	0.5

NOTES:

8	1	3:59	4:09	10	2	10	8	1.2	0.8
	2	4:09	4:19	10	2	8	6	1.6	0.6
	3	4:19	4:29	10	2 1/2	7 1/2	5	2.0	0.5
	4	4:29	4:39	10	2	7	5	2.0	0.5
	5	4:39	4:49	10	3	8	5	2.0	0.5

NOTES:

PERCOLATION TEST DATA SHEET

DATE: 5-6-89

LOCATION: California

ENGINEER: T. Smith

DEPTH OF PERK TESTS: 4' (12" hole)

HOLE NO.	RUN NO.	CLOCK TIME START	CLOCK TIME STOP	ELAPSED TIME (MIN)	DEPTH TO WATER FROM SURFACE (INCHES) START	DEPTH TO WATER FROM SURFACE (INCHES) STOP	TOTAL WATER DROP (IN)	SOIL RATE (MIN/IN)	In/min
9	1	4:01	4:11	10	2	10½	8½	1.2	0.85
	2	4:12	4:22	10	3	9½	6½	1.5	0.65
	3	4:22	4:32	10	2½	9½	7	1.4	0.7
	4	4:32	4:42	10	2½	10	7½	1.3	0.75
	5	4:43	4:53	10	3	9	6	1.6	0.6
NOTES:		4:53	5:03	10	2	8	6	.	0.6

HOLE NO.	RUN NO.	CLOCK TIME START	CLOCK TIME STOP	ELAPSED TIME (MIN)	DEPTH TO WATER FROM SURFACE (INCHES) START	DEPTH TO WATER FROM SURFACE (INCHES) STOP	TOTAL WATER DROP (IN)	SOIL RATE (MIN/IN)	In/min
10	1	4:03	4:13	10	3	12	9	1.1	0.9
	2	4:13	4:23	10	4	11½	7½	1.3	0.75
	3	4:23	4:33	10	2½	10½	8	1.2	0.8
	4	4:33	4:43	10	3	10	7	1.4	0.7
	5	4:43	4:53	10	3	9	6	1.6	0.6
NOTES:		4:53	5:03	10	2½	8½	6	1.6	0.6