State of Oregon

Department of Environmental Quality Guidelines

Guidelines for Writing Wastewater Engineering Design and Pre-Design Reports - 1994

INTRODUCTION

These guidelines outline topics that we normally expect to be covered in wastewater design reports, pre-design reports, and the engineering design aspects of facility planning reports. The guidelines are also intended to apply to wastewater engineering studies of lesser scope. For example: facility plan technical supplements, sewage works technical memoranda, engineer's letter reports, etc.

Typical pumping and activated sludge systems are used as examples. For other processes, the engineer should provide comparable descriptions and analysis. Some of the topics may not apply in a particular situation. However, where the topic applies, engineering reports should achieve the objectives and level of detail indicated below and illustrated in the attached examples.

PURPOSE

A primary function of facility plans and engineering reports is to allow for review and consensus on design features prior to starting a final design. Principal reviewers should normally include the public works operations staff and the engineer's senior reviewers. However, since the Department of Environmental Quality (DEQ) is responsible for approving each municipal sewage works design in Oregon, DEQ review of these reports is also strongly encouraged prior to authorizing the start of final design.

The objective of scheduling early DEQ review is to save time and effort later. DEQ's concurrence with the proposed design criteria will minimize re-design and re-review costs. Scheduling the time to make DEQ review staff familiar with a project from its outset helps assure that final regulatory approval is issued with the minimum possible delay.

SEWAGE PUMPING FACILITIES

Background

Provide background which presents the overall context for each pump station. This may be a paragraph or an entire section, depending on service area, discharge point, overflow aspects, complexity, size, location, and so on.

Note: These guidelines replace our 1992 guidelines for pre-design reports, which are obsolete and should be discarded.

Design Data

The design characteristics of each pump station and forcemain should be tabulated as shown in the attached "Pump Station Design Data" example. As may be appropriate, the report should also address items described in DEQ's guidelines for pump station plan submittals (available on request).

Existing Pump Stations

Current pumping capacity, extent of wear, and overall station condition and reliability need to be determined in the field. As a minimum, the discharge side of each pump needs to be gauged to measure actual pumping head. Current shutoff head should be compared with shutoff as shown on the manufacturer's pump curve. Current pumping capacity should be compared with design capacity. Station reliability, safety, and controls need to be evaluated against future requirements.

Existing Force Mains

The discharge manhole of each existing force main needs to be inspected in the field. Too often the manhole and nearby concrete sewer are on the verge of collapse by the time an existing pump station is evaluated for upgrading.

An accurate corrosion inspection cannot be made visually. It involves kneeling by the open manhole and probing around the inside cone with a knife or screwdriver blade to determine the extent of concrete deterioration inside the roof of the manhole. The report should describe the date, tool or probe used, and results found.

If significant corrosion is found, then immediate repairs or further investigations may be warranted. For example, a manned descent to measure the depth of pipe crown loss, and perhaps TV'ing the sewer to determine the extent of damage downstream.

In connection with sulfide corrosion, the report should determine whether sulfide controls are warranted and what type. As a rule of thumb, discharges of H2S into gravity sewers should not exceed 0.1 mg/l in accordance with DEQ's guidelines for H2S field testing (available on request).

SEWAGE TREATMENT FACILITIES

Existing Treatment Works

<u>Background</u> - Establish the general context of existing facilities being described, such as history of development, special features, similarities or unique aspects, and so on. This may be a paragraph or an entire section, depending on the existing facility and the project being proposed.

<u>Description</u> - Normally a detailed summary of design data is necessary to describe existing facilities being evaluated. Unless ample detail was originally provided in an operations manual or other reference, the engineer will need to develop additional detail through field inspections and measurements. The level of detail should be as illustrated in the attached examples.

<u>Present Condition and Service Life</u> - The engineer should evaluate current maintenance needs and identify components needing refurbishment, replacement, improvement, abandonment, demolition, etc. Describe any particular maintenance or operational difficulties, access problems, poor availability or excessive costs of factory service or spare parts, etc.

<u>Performance Evaluation</u> - Document evaluations of equipment, unit processes, and components with reference to standard or current design practice, current loadings, plant records, and similar facilities. Evaluations may often require specific performance tests or observations to be made in the field. For example: current versus design pump shutoff head and capacity, scum buildup, flow stacking, surging, uneven weirs, hydraulic bottlenecks or short-circuits, metering deficiencies, unrepresentative sampling, poor mixing, deferred maintenance, etc.

Proposed Process Designs

Provide a Process Design section, starting with an introduction and general approach. This section is important because it may provide the sole record of design intent. It should be sufficiently detailed to document proposed design criteria.

<u>Effluent Requirements</u> - The effluent requirements should be summarized in tabular form. Include:

- EPA reliability class of the facility
- permitted or required effluent quality and mass loadings
- anticipated effluent quality

<u>Process Design Criteria</u> - The process design criteria should be tabulated. This includes initial and future flows and waste strengths, with flow projections developed in accordance with DEQ guidelines (available on request). Provide a design data summary table indicating the critical design parameters of units, processes, and equipment. The attached examples indicate the desired level of detail for such items:

- design population and flows
- raw sewage characteristics and loadings
- septage characteristics and loadings
- on-site lift station design data
- headworks type, sizing, capacity of all components
- primary clarifier type, sizing (LWD), capacity, and overflow rate
- primary effluent characteristics and loadings on the secondary process
- aeration basin type, size (LWD), detention, oxygen uptake, design MLSS, and sludge yield for main and alternate modes of operation
- aeration system type, sizing, capacity, efficiency, and output including both diffusers, blowers, and related equipment
- secondary clarifier type, sizing (LWD), capacity, overflow rate, and solids loading
- WAS and RAS pumping design data
- chlorination/dechlorination feeders type, sizing, capacity
- chlorination/dechlorination mixer type, sizing, velocity gradient, and mixing volume
- contact basin configuration, sizing, volume, detention time, L:W ratio
- chemical feeders and mixers type, size, capacity, detention time
- chemical clarifier type, sizing, overflow rate, solids loading, sludge yield and recycle
- effluent filter type, sizing, hydraulic loading, and backwash data
- outfall design data, diffuser data, submergence, and dilution factors
- sludge characteristics and sludge pumping design data
- sludge thickener type, sizing, area, solids loading, overflow rate, and capacity
- digester type, sizing, detention time, and solids loading
- digester auxiliary equipment design data (grinders, mixers, heaters, compressors, etc.)
- sludge dewatering type, sizing, loading, hours of operation
- sludge disposal method, equipment, trips per day
- recycle streams and loadings
- flowmeter types, applications, and capacities
- standby power type, sizing, and capacity
- plant water systems type, sizing, and capacity

A complete tabulation is expected to be printed in the construction plans, as well as in design reports, as a permanent reference. Generally the tabulation should reflect both current improvements and previous facilities to remain. The objective is to have one tabulation which reflects the entire plant, and which can later be copied for inclusion in the operations manual.

Hydraulic Profile - Draw a hydraulic profile reflecting the peak instantaneous design flowrate. Pertinent data should include proposed flowrates in parallel trains, elevations, flow controls, 100-year flood elevation, and finish grade at structures. Despite availability of the profile in a design report, it is also expected to be printed in the construction plans for permanent reference.

Process Control - Write a description of process flow and bypassing options for each component, including solids handling. This text may serve as a basis for a "Control Strategies" section later to be included in the specifications, and eventually providing the operational concepts for the O&M (operations and maintenance) manual.

Process Schematics - Schematic diagrams should show chemical addition and sampling points. Sometimes all three types of diagrams need to be drawn separately for clarity:

- Draw a liquid-stream process diagram showing alternative flow options,• normal modes and bypasses, drains, recycles, and blow-downs.
- Draw a sludge process diagram showing flow-meters, drains, recycles, and• alternate processing modes.
- Draw a solids balance for the treatment plant documenting adequacy of• sludge metering, pumping, and processing units.

Facility Pre-Design and Preliminary Design

Pre-design reports should include a facility design section indicating the design approach and selection of process components. The level of detail will depend on the scope of the proposed project.

Plant Layout - Describe the arrangement and site development to accommodate the improvements. Include a site plan showing the footprints of existing and proposed components.

Process Components - Describe each of the process components in turn, including:

- objectives of the process
- configuration and flow schemes
- type, sizing, and loading factors
- operational modes
- bypassing and emergency operations
- surface treatment and corrosion protection
- modifications to existing components
- water supply and drains

Process Schematics and Plans - Provide process schematics and outline plans and sections of systems and components to be designed. The level of detail will depend on the complexity of the project. Typically include:

- outline layout or arrangement
- elevations
- water surfaces
- major piping

Sampling Systems - Describe the objectives and controls for the sampling systems proposed. Include:

- locations
- sampling methods
- sampling equipment and controls

Site Piping - Tabulate major piping applications and service conditions, materials, and installation conditions. Identify special concerns, such as corrosion and solids deposition, and proposed solutions.

Reliability and Standby Power - Describe the potential for failure and disruption of service for critical process components, and the design criteria that will provide continued treatment for a particular reliability class. The class of reliability should be as described in EPA Technical Bulletin EPA-430-99-74-001: *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability*. Describe the degree of redundancy or back-up system proposed for each critical process or component. Describe the potential for power outages. Provide utility power-outage documentation to justify the proposed reliability conditions and degree of redundancy.

Electrical - It would be desirable to describe and tabulate major process electrical loads. Indicate type of equipment, number, size, horsepower, voltage, and controls.

Site Drainage - Describe storm drainage facilities and isolation measures to prevent spillage of sludge, sewage, or screenings into the storm drainage system.

Geotechnical - Describe the geotechnical factors that will affect the design. Factors may include:

- topography and effects of site layout or construction
- soil profile and effects on earthwork and structural design
- water table effects
- results of geotechnical investigations
- types of structure and foundations to be designed to meet geotechnical conditions

Heating, Ventilating, and Air Conditioning - It is desirable to describe HVAC sizing for major air handling and heating units.

Project Implementation

Provide a section on implementation:

Schedule - Update the project schedule.

Operation During Construction - Describe how existing facilities will be operated during construction of the proposed improvements, and especially how permit limits will be achieved. Include a preliminary feasible construction sequence.

Cost Estimates

Provide updated cost estimates for construction and for operation and maintenance. Address discrepancies or departures from prior estimates and adequacy of funding for the proposed project. It may often be desirable to provide a table of estimated cash flow requirements.

Appendices

Provide a preliminary list of drawings and specification section headings.

DEQ REVIEWS AND RESPONSE TIME

The information provided in engineering design and pre-design reports should allow subsequent work to proceed with a clear understanding of major design features and criteria. Following review and consensus, preparation of construction documents should then proceed with relative confidence.

Periodic design reviews should also be conducted by the engineer. Reviews at approximately 10, 40, and 70 percent completion have been beneficial to DEQ's review process, contributing to extremely speedy review of final construction documents. Very often DEQ review staff can complete approval of final plans in a few hours or days where projects had interim design reviews, in contrast to several weeks otherwise.

INQUIRIES

Inquiries about these guidelines should be directed to DEQ regional water-quality plan review engineers.

EXAMPLES

The attached examples should be used as a guide to the content and level of detail for design data, process diagrams, hydraulic profiles, and preliminary drawings.

1 - Pump Station Design Data

2 - Design Data, Secondary Treatment

3 - Design Data, Solids and Chemical Advanced Treatment

4 - Hydraulic Profile, Secondary Treatment

5 - Hydraulic Profile, Advanced Treatment

6 - Flow Diagram w/ Valve and Control Designations

7 - Overall Liquid Process Schematic

8 - Flow Diagram w/ Solids Balance

9 - Flow Diagram w/ Sample Points and Chemical Addition

10 - Lagoon Profile, Flow Diagram, and Design Data

11 - Solids Schematic and Balance

12 - Preliminary Outline Plan Drawing

13 - Preliminary Section

DSM: ENGREPTS1.DSM

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SEWAGE PUMP STATION DESIGN DATA EXAMPLE

In the plans, print a schedule or list of the following items for new and modified pump stations:

PUMP STATION	Location @ ?
Type	Duplex self-priming? Submersible?
Pump Type	Constant-speed non-clog? VS?
Capacity	?? gpm @ ?? ft Total Dynamic Head
Pump HP (each)	?? HP
Level Control Type	Bubbler w/ duplex compressors??
Overflow Point	Overflow elevation and location
Overflow Discharge	Trout Creek? Playground? Sinkhole?
Avg. Time to Overflow	?? hours @ zz gpm design avg Q
Auxiliary Power Type	Portable diesel generator?
Location	City Shops? STP?
Output	?? KW?
Fuel Tank Capacity	? hours ?
Transfer Switch	Auto? Manual?
Alarm Telemetry Type	Autodialer ? Radio telemetry?
EPA Reliability Class	I ? or II (if no back-up)?
FORCE MAIN	
Length, Type	x00' of ?" PVC?
Profile	Continuously Ascending & z%?
Discharge Manhole	28th and Nobby?
Air Release Valves	None?
Vacuum Release Valves	One at high point, 28th & Annie???
*Average Detention	xy? min @ start-up, yz min @ ult.
Sulfide Control System	Backdrainage? Aeration? None?
BACKDRAINAGE SYSTEM (if any)	
Control Valve Type	Pneumatic Pinch? Knife-gate?
Valve Size	4"?
AIR INJECTION SYSTEM (if any)	
Compressor HP, Type	4.5 HP receiver-mounted reciprocating?
Standard Injection Rate	8 SCFM?
Actual Air Rate	3.2 SCFM @ 50' TDH?
Air Flowmeter Capacity	0.5 - 5 CFM? 30 - 300 CFH?
CHEMICAL FEED SYSTEM (if any)	
Type	50% Peroxide? Permanganate? 12% Hypochlorite?
Pump Type	VS Diaphragm?
Capacity	x gph?
Reaction time	y minutes available
Dose control	meter? stroke counter?

*If detention in the main exceeds average 25 to 30 min. between pump cycles at start-up, sulfide controls will probably be needed.

DESIGN DATA

EXAMPLE - LEVEL OF DETAIL NECESSARY

ITEM	VALUE DESIGN	VALUE FUTURE
PLANT FLOW		
AVERAGE DRY WEATHER, MGD	0.6	0.75
PEAK MONTHLY AVERAGE, MGD	1.1	1.1
PEAK DAILY AVERAGE, MGD	2.5	3.2
PEAK WET WEATHER, MGD	3.2	4.6
PLANT LOAD		
BOD AVERAGE, PPD	1,130	1,730
BOD MAXIMUM MONTH, PPD	1,350	2,130
SS AVERAGE, PPD	1,350	2,020
SS MAXIMUM MONTH, PPD	2,336	3,336
INFLUENT SEWAGE PUMPING STATION		
TYPE OF PUMPS: NON-CLOG VERTICAL TURBINE, VARIABLE SPEED		
NUMBER OF PUMPS	3	3
CAPACITY, EACH, MGD	[illegible]	4.6
HORSEPOWER, EACH	30	
OVERFLOW 30 FEET [illegible] DIAMETER, INCHES	12	12
WET WELL STORAGE BEFORE OVERFLOW AT 3.2 MGD, MINUTES	10	10
HEADWORKS		
ROTATING DRUM SCREEN		
NUMBER	1	1
DIAMETER, INCHES	36	36
LENGTH OF DRUM, INCHES	72	72
SPACING BETWEEN [illegible], INCHES	0.1	0.1
CAPACITY, MGD, AT [illegible] CONCENTRATION OF 250 mg/L	3.2	4.6
HAND RAKED BAR SCREEN		
NUMBER	1	1
SPACING BETWEEN BARS, INCHES	1.0	1.0
CAPACITY, MGD	4.6	4.6
SCREENINGS COMPACTOR		
TYPE: PLUNGER OR AUGER		
NUMBER	1	1
WET SCREENINGS CAPACITY, CU FT/HR	12	12
GRIT REMOVAL		
AERATED GRIT TANK		
NUMBER OF BASINS	1	1
LENGTH, FEET	17.33	17.33
WIDTH, FEET	12	12
AVERAGE SEPTAL FEET	8	8
VOLUME, GALLONS	12,440	12,440
DETENTION TIME AT PWWF, MINUTES	5	4
AIRFLOW, SCFM	36	38
GRIT PUMPING		
TYPE: RECESSED IMPELLER		
NUMBER OF PUMPS	1	1
CAPACITY, GPM AT 30 FEET TDH	100	100
HORSEPOWER	7.5	7.5
GRIT SEPARATION		
CYCLONE SEPARATOR		
NUMBER	1	1
CAPACITY, GPM AT 6 PSI	270	270
GRIT WASHER		
TYPE: SCREW CLASSIFIER		
NUMBER	1	1
SCREW DIAMETER, INCHES	12	12
CAPACITY, POUNDS PER HOUR	1,500	1,500

ITEM	VALUE DESIGN	VALUE FUTURE
SECONDARY TREATMENT		
AERATION BASINS		
NUMBER	2	3
WIDTH, FEET	12.67	12.67
WATER DEPTH, FEET	13.8	13.8
BASIN 1		
TYPE: 3-CELL ANOXIC SELECTOR WITH 1 AEROBIC CELL		
LENGTH, FEET	102	102
VOLUME, 1000 GALLONS	137	137
VOLUME ANOXIC CELLS, 1000 GALLONS		
CELL 1	10	10
CELL 2	14	14
CELL 3	42	42
VOLUME, AEROBIC CELL, 1000 GALLONS	78	78
ANOXIC CELL MIXERS		
TYPE: SUBMERSIBLE PROPELLER		
NUMBER	4	4
HORSEPOWER, EACH	2.2	2.2
BASIN 2		
TYPE: 1-CELL AEROBIC		
LENGTH, FEET	89.5	89.5
VOLUME, 1000 GALLONS	114	114
BASIN 3		
TYPE: 1-CELL AEROBIC		
LENGTH, FEET	-	102
VOLUME, 1000 GALLONS	-	137
DIFFUSER TYPE, FINE BUBBLE FLEXIBLE MEMBRANE		
SECONDARY PROCESS PERFORMANCE		
MAXIMUM MONTH LOAD		
MLSS IN AERATION BASIN, mg/L	2,000	2,000
RAS [illegible] SLUDGE, mg/L	8,000	8,000
F/M, LB BOD/LB MLVSS/DAY	0.37	0.37
SLUDGE AGE, DAYS	3	3
HYDRAULIC DETENTION TIME AT PEAK MONTH AVERAGE FLOW, HOURS	6	6
BLOWERS, AERATION AND DIGESTION		
TYPE: POSITIVE DISPLACEMENT		
NUMBER, STANDBY	1	
NUMBER AND CAPACITY, EACH SCFM/HORSEPOWER		
AERATION (NEW, VARIABLE SPEED)	1-1,500/75	2-1,500/75
DIGESTION (EXISTING 2-SPEED)	1-630/30 HI SPD 410/30 LO SPD	1-1,500/75 (NEW)
STANDBY (EXISTING)	1-800/40	1-800/40
AIR REQUIRED FOR AERATION, SCFM		
AVERAGE	360	560
MAXIMUM DAY	1,330	1,500
SECONDARY CLARIFIERS		
TYPE: INBOARD WEIR, FLOCCULATOR		
NUMBER	2	2
DIAMETER, FEET	48	48
SIDE WATER DEPTH, FEET	16	16
OVERFLOW RATE AT PWWF, GPD/SQ FT	1,000	1,000
OVERFLOW RATE AT PEAK DAILY FLOW, GPD/SQ FT	640	640
OVERFLOW RATE AT 33% PWWF WITH ONE CLARIFIER OUT OF SERVICE, GPD/SQ FT	1,300	1,100
NUMBER OF SLUDGE LEVEL [illegible] PORTS PER CLARIFIER	3	3

ITEM	VALUE DESIGN	VALUE FUTURE
RETURN SLUDGE PUMPS		
TYPE: NON-CLOG HORIZONTAL CENTRIFUGAL, VARIABLE-SPEED		
NUMBER	3	4
CAPACITY, EACH, GPM	50-370	50-370
HORSEPOWER, EACH	3	3
SLUDGE WASTING CAPACITY, GPM	15-40	15-40
WAS FLOW METER		
TYPE: MAGNETIC		
CAPACITY, GPM	40	40
ULTRAVIOLET DISINFECTION—OPEN CHANNEL VERTICAL TYPE		
UV DISINFECTION CHANNELS		
NUMBER	1	1
LENGTH, INCHES	224	224
WIDTH, INCHES	16.25	16.25
DEPTH, INCHES	45.5	45.5
CAPACITY, EACH, MGD	3.6	3.6
LAMPS		
NUMBER PER MODULE	20	20
TOTAL NUMBER OF MODULES/CHANNEL	3	4
FLOW CAPACITY, PER MODULE, MGD	0.34	0.40
POWER CONSUMPTION, PER MODULE, KW	2.30	2.30
UV DOSE AT PWWF, 70% OUTPUT, 65% TRANSMISSION, MICROWATT-SEC/SQ CM	34,870	34,880
EXPOSURE AT PWWF, SECONDS	12.2	14.1
AEROBIC DIGESTION		
DIGESTER BASIN (3-CELL SERIES TYPE)		
VOLUME, EACH CELL, GALLONS	2-122,000 / 1-118,000	2-122,000 / 1-118,000
FUTURE DIGESTER BASIN, VOLUME, GALLONS		131,300
MAXIMUM MONTH SLUDGE LOADING, GPD AT 0.8% SOLIDS	18,800	27,300
HYDRAULIC DETENTION TIME, DAYS	20	20
SOLIDS RETENTION TIME, DAYS	22	18
PEAK MONTH AIR REQUIREMENT, SCFM	630	1,300
DIGESTED SLUDGE FLOWMETER		
TYPE: MAGNETIC		
CAPACITY, GPM	350	350
LIQUID SLUDGE LOADING SYSTEM		
EXISTING		
FEED PUMP		
TYPE: CENTRIFUGAL		
CAPACITY, GPM	350	350
HORSEPOWER	3	3
AIR LIFT SLUDGE PUMPS		
TYPE: AIR LIFT		
NUMBER	2	2
DIAMETER, INCHES	4	4
CAPACITY AT 3 FEET LIFT AND 60% SUBMERGENCE, EACH, GPM	175	175
AIR REQUIREMENT, EACH, SCFM	35	35
SLUDGE THICKENING		
SCREW PRESS FEED PUMP		
EXISTING		
TYPE: PROGRESSIVE CAVITY, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPM	5-17	5-17
HORSEPOWER	2	2
AVERAGE SLUDGE FEED RATE, GPD, AT 2.5% SOLIDS	3,330	6,025

ITEM	VALUE DESIGN	VALUE FUTURE
SCREW PRESS FEED FLOW METERS		
TYPE: MAGNETIC		
NUMBER	2	2
CAPACITY, GPM	15/25	15/25
SCREW PRESSES		
EXISTING		
NUMBER	1	1
CAPACITY, DRY SOLIDS, LB/HR	150	150
CAPACITY, GPM	15	15
PERCENT CAPTURE, MIN	92.5	92.5
NEW		
NUMBER	1	1
CAPACITY, DRY SOLIDS, LB/HR	330	330
CAPACITY, GPM	25	25
PERCENT CAPTURE, MIN	92.5	92.5
POLYMER FEED SYSTEM		
POLYMER DOSE, LBS/TON DRY SOLIDS	8-15	8-15
EXISTING		
NEAT POLYMER FEED PUMP		
TYPE: MECHANICAL DIAPHRAGM, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPH	3-104	3-104
HORSEPOWER	0.5	0.5
POLYMER MIXING TANK, VOLUME, GALLONS	500	500
POLYMER SOLUTION MIXER, HORSEPOWER	0.5	0.5
NEW		
NEAT POLYMER DRUM MIXER, HORSEPOWER	0.5	0.5
POLYMER SOLUTION FEED PUMP		
TYPE: PROGRESSIVE CAVITY, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPM	1-10	1-10
HORSEPOWER	1	1
SLUDGE STORAGE		
EXISTING		
AIR DRYING BEDS		
NUMBER	2	2
TOTAL AREA, SQ FT	4,313	4,313
PLANT WATER		
PUMPS		
TYPE: VERTICAL TURBINE		
NUMBER	2	2
CAPACITY, EACH, GPM	65	65
HORSEPOWER	5	5
HYDROPNEUMATIC TANK, VOLUME, GALLONS	134	134
SERVICE AIR COMPRESSOR		
TYPE: AIR COOLED RECIPROCATING		
CAPACITY, ACFM AT 100 PSIG	13	13
HORSEPOWER	3	3
EFFLUENT FLOW METER		
TYPE: IN-LINE SONIC		
RANGE, MGD	0.072-4.6	0.072-4.6
AVERAGE MONTHLY PLANT EFFLUENT REQUIREMENTS*		
BOD AND SS, PPD JUNE-OCTOBER	75	75
BOD AND SS, PPD NOVEMBER-MAY	113	113
* MASS LOAD GOVERNS CONCENTRATION AT ALL DESIGN FLOWS		
ANTICIPATED EFFLUENT QUALITY		
BOD AND SS, mg/L JUNE-OCTOBER	10-30	10-30
BOD AND SS, mg/L NOVEMBER-MAY	10-30	10-30

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WASTEWATER TREATMENT PLANT IMPROVEMENTS

DESIGN DATA

SCALE: NONE

DRAWING NUMBER: G5

Design Data Summary, Secondary Treatment

EXAMPLE

NOTE LEVEL OF DETAIL

ROCK CREEK ADVANCED WASTEWATER TREATMENT PLANT
UNIT PROCESS DESIGN SUMMARY
PHASE 4 EXPANSION

DEWATERING BUILDING

DEWATERING DESIGN BASIS (LB/DAY)	1990	2010	ULTIMATE
DRY WEATHER MAX MONTH	36,200	47,800	84,800
DRY WEATHER MAX WEEK	36,800	48,100	104,400

BELT FILTER PRESSES	
NUMBER — INITIAL	6
NUMBER — ULTIMATE	8
SIZE	2 METER
CAPACITY PER UNIT	250 GPM
	1,200 LB/HR
BELT PRESS FEED PUMPS	2
TYPE	SCREW-INDUCED FLOW CENT.
RATED CAPACITY	1,000 GPM @ 120 FT
DRIVE TYPE	ADJUSTABLE SPEED
MOTOR	60 HP, 1,800 RPM
WASHWATER BOOSTER PUMPS	2
TYPE	HORIZ. END-SUCT. CENT.
RATED CAPACITY	400 GPM @ 86 FT
DRIVE TYPE	ADJUSTABLE SPEED
MOTOR	15 HP, 1,750 RPM
BULK DRY POLYMER SYSTEM	
STORAGE SILO CAPACITY	60,000 LBS
BIN DISCHARGER CAPACITY	1,120 CUFT/HR
WEIGH FEEDER CAPACITY	8 LBS/MIN
SILO FILTER BAGHOUSE TYPE	REVERSE AIR PULSE
CAPACITY	65 SQFT CLOTH, MIN.
DRY POLY COMPRESSED AIR SYSTEM CAPACITY	200 SCFM
DRY POLY WETTING DEVICES	3 UNITS
CAPACITY	8 LB/MIN EACH
BULK LIQUID POLYMER SYSTEM	
STORAGE TANKS	2
CAPACITY	3,750 GAL
TRANSFER PUMPS	2
TYPE	PROGRESSING CAVITY
RATED CAPACITY	30 GPM @ 25 PSI
DRIVE TYPE	ADJUSTABLE SPEED
MOTOR	3 HP, 1,800 RPM
MIX TANKS	3
CAPACITY	2,500 GAL
MIXER SIZE	2 HP
SOLUTION TRANSFER PUMPS	3
TYPE	PROGRESSING CAVITY
RATED CAPACITY	150 GPM @ 100 PSI
DRIVE TYPE	CONSTANT SPEED
MOTOR	20 HP, 1,800 RPM
DEWATERING POLYMER SYSTEM	
FEED TANK CAPACITY	3,300 GAL
FEED PUMPS	3
TYPE	PROGRESSING CAVITY
RATED CAPACITY	20 GPM @ 100 PSI
DRIVE TYPE	ADJUSTABLE SPEED
MOTOR	7.5 HP, 1,800 RPM
THICKENING POLYMER SYSTEM	
FEED TANK CAPACITY	3,300 GAL
FEED PUMPS	2
TYPE	PROGRESSING CAVITY
RATED CAPACITY	3 GPM @ 100 PSI
DRIVE TYPE	ADJUSTABLE SPEED
MOTOR	2 HP, 1,800 RPM

ODOR CONTROL SYSTEM	
SCRUBBERS	2
DIAMETER	12 FEET
PACKING HEIGHT	12 FEET
DESIGN FLOW RATE	45,000 CFM
RECIRCULATING PUMPS	2
TYPE	HORIZ. END-SUCT. CENT.
RATED CAPACITY	850 GPM @ 33 FT
DRIVE TYPE	CONSTANT SPEED
MOTOR	15 HP, 1,800 RPM
HYPOCHLORITE STORAGE	450 GAL
SODIUM HYDROXIDE STORAGE	50 GAL
HYPOCHLORITE METERING PUMPS	2
TYPE	MECH. DIAPHRAGM METERING
MAXIMUM CAPACITY	300 GPH @ 60 PSIG
DRIVE TYPE	CONSTANT SPEED
MOTOR	3/4 HP, 1,800 RPM CHEM DUTY
SODIUM HYDROXIDE METERING PUMPS	2
TYPE	MECH. DIAPHRAGM METERING
MAXIMUM CAPACITY	50 GPH @ 250 PSIG
DRIVE TYPE	CONSTANT SPEED
MOTOR	1/2 HP, 1,800 RPM CHEM DUTY

CHEMICAL BUILDING

ALUM SYSTEM	
STORAGE TANKS	2 @ 22,400 GAL EACH
TRANSFER PUMPS	4
TYPE	CHEM-DUTY CENTRIFUGAL
RATED CAPACITY	2 - 95 GPM @ 24 FT 1 - 26 GPM @ 27 FT 2 - 20 GPM @ 29 FT
DRIVE TYPE	CONSTANT SPEED
MOTOR	3 HP, 1,800 RPM
METERING PUMPS	3
TYPE	MECH. DIAPHRAGM METERING
MAXIMUM CAPACITY	300 GPH @ 50 PSIG
DRIVE TYPE	ADJUSTABLE SPEED
MOTOR	3/4 HP, 1,800 RPM, CHEM DUTY
FERRIC CHLORIDE SYSTEM	
STORAGE TANK	1 @ 11,000 GAL
TRANSFER PUMPS	2
TYPE	CHEM-DUTY CENTRIFUGAL
RATED CAPACITY	20 GPM @ 27 FT
DRIVE TYPE	CONSTANT SPEED
MOTOR	3 HP, 1,800 RPM
METERING PUMPS	2
TYPE	MECH. DIAPHRAGM METERING
MAXIMUM CAPACITY	300 GPH @ 60 PSIG
DRIVE TYPE	CONSTANT SPEED
MOTOR	3/4 HP, 1,800 RPM, CHEM DUTY
SODIUM HYPOCHLORITE SYSTEM	
STORAGE TANK	1 @ 11,000 GAL
TRANSFER PUMPS	4
TYPE	CHEM-DUTY CENTRIFUGAL
RATED CAPACITY	2 - 30 GPM @ 25 FT 2 - 55 GPM @ 105 FT 1 - 40 GPM @ 22 FT 1 - 44 GPM @ 110 FT
DRIVE TYPE	VARIABLE SPEED
MOTOR	3 - 3 HP, 1,800 RPM, CHEM DUTY 3 - 5 HP, 3,600 RPM, CHEM DUTY
SODIUM BISULFITE SYSTEM	
STORAGE TANK	1 @ 11,000 GAL
TRANSFER PUMPS	2
TYPE	CHEM-DUTY CENTRIFUGAL
RATED CAPACITY	25 GPM @ 27 FT
DRIVE TYPE	VARIABLE SPEED
MOTOR	3 HP, 1,800 RPM, CHEM DUTY

LIME SYSTEM — DESIGN BASIS	MIN	AVG	MAX
ALKALINITY ADDITION (mg/L as $CaCO_3$)	75	150	250
HYDRATED LIME DOSE (mg/L)	54	96	185
FLOW (MGD)	6.0	23.2	30.0

STORAGE SILOS	2
VOLUME PER SILO	4,600 CUFT
VOLUMETRIC LIME SCREW FEEDERS	2
CAPACITY	60 CUFT/HR

PRIMARY CLARIFIER MODIFICATIONS

CLARIFIER #6 DESIGN CRITERIA	AVERAGE	PEAK
FLOW (MGD)	6.7	16.7
OVERFLOW RATE (GPD/SQFT)	800	2,000

PRIMARY CLARIFIER NUMBER 6	
AREA	194 FT x 42 FT
NOMINAL SIDEWATER DEPTH	8 FT
PRIMARY SLUDGE PUMPS (ALL CLARIFIERS)	6
TYPE	AIR-DRIVEN DIAPHRAGM
RATED CAPACITY	75 GPM @ 45 FT
PRIMARY SCUM PUMP (CLARIFIER NO. 6)	1
TYPE	AIR-DRIVEN DIAPHRAGM
RATED CAPACITY	75 GPM @ 45 FT

DIGESTER COMPLEX

DIGESTER 5 AND 6 DESIGN CRITERIA	
COMBINED VOLUME	450,000 CUFT
DETENTION TIME	20 DAYS
DIGESTER FEED AND TRANSFER SYSTEMS	
DIGESTER FEED SLUDGE TANKS	2
VOLUME PER TANK	8,600 GALLONS
DIGESTER FEED MIXING PUMP	1
TYPE	SCREW-INDUCED FLOW CENT.
RATED CAPACITY	300 GPM @ 10 FT
DRIVE TYPE	CONSTANT SPEED
MOTOR	3 HP, 1,200 RPM
DIGESTER FEED PUMPS	2
TYPE	PROGRESSING CAVITY
RATED CAPACITY	300 GPM @ 45 PSI
DRIVE TYPE	CONSTANT SPEED
MOTOR	30 HP, 1,800 RPM
SLUDGE TRANSFER PUMPS	3
TYPE	SCREW-INDUCED FLOW CENT.
RATED CAPACITY	500 GPM @ 45 FT
DRIVE TYPE	CONSTANT SPEED
MOTOR	15 HP, 1,800 RPM
DIGESTER MIXING	
MIXING PUMPS FOR DIGESTERS 1-4	4
TYPE	SCREW-INDUCED FLOW CENT.
RATED CAPACITY	10,000 GPM @ 12 FT
DRIVE TYPE	CONSTANT SPEED
MOTOR	50 HP, 1,800 RPM
MIXING PUMPS FOR NEW DIGESTERS 5-6	3
TYPE	SCREW-INDUCED FLOW CENT.
RATED CAPACITY	10,000 GPM @ 15 FT
DRIVE TYPE	CONSTANT SPEED
MOTOR	60 HP, 1,200 RPM

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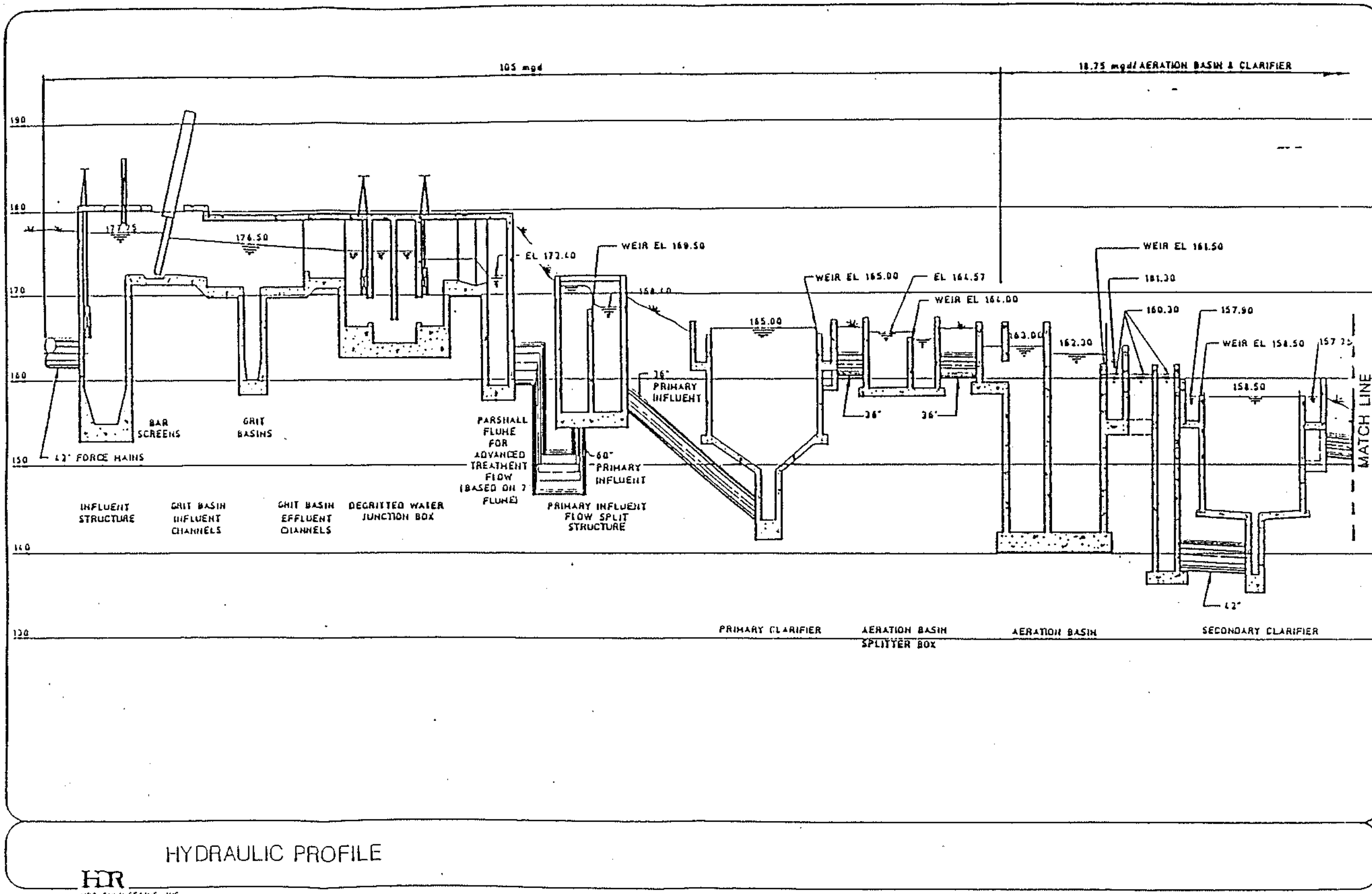
ROCK CREEK FACILITY — UNIFIED SEWERAGE AGENCY, WASHINGTON COUNTY, OREGON

PHASE 4 EXPANSION - SOLIDS PROCESSING GENERAL

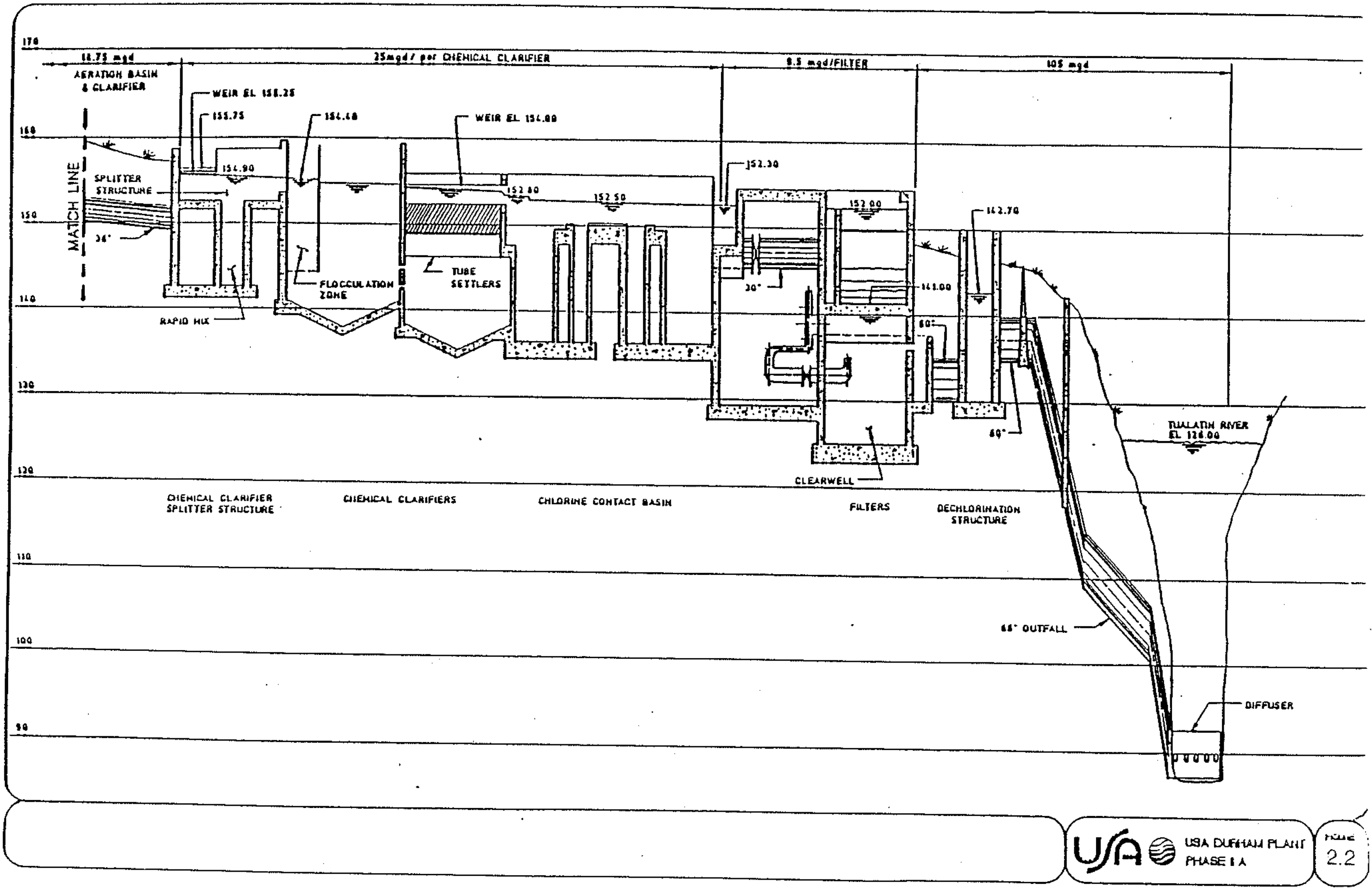
DESIGN SUMMARY

SHEET 12

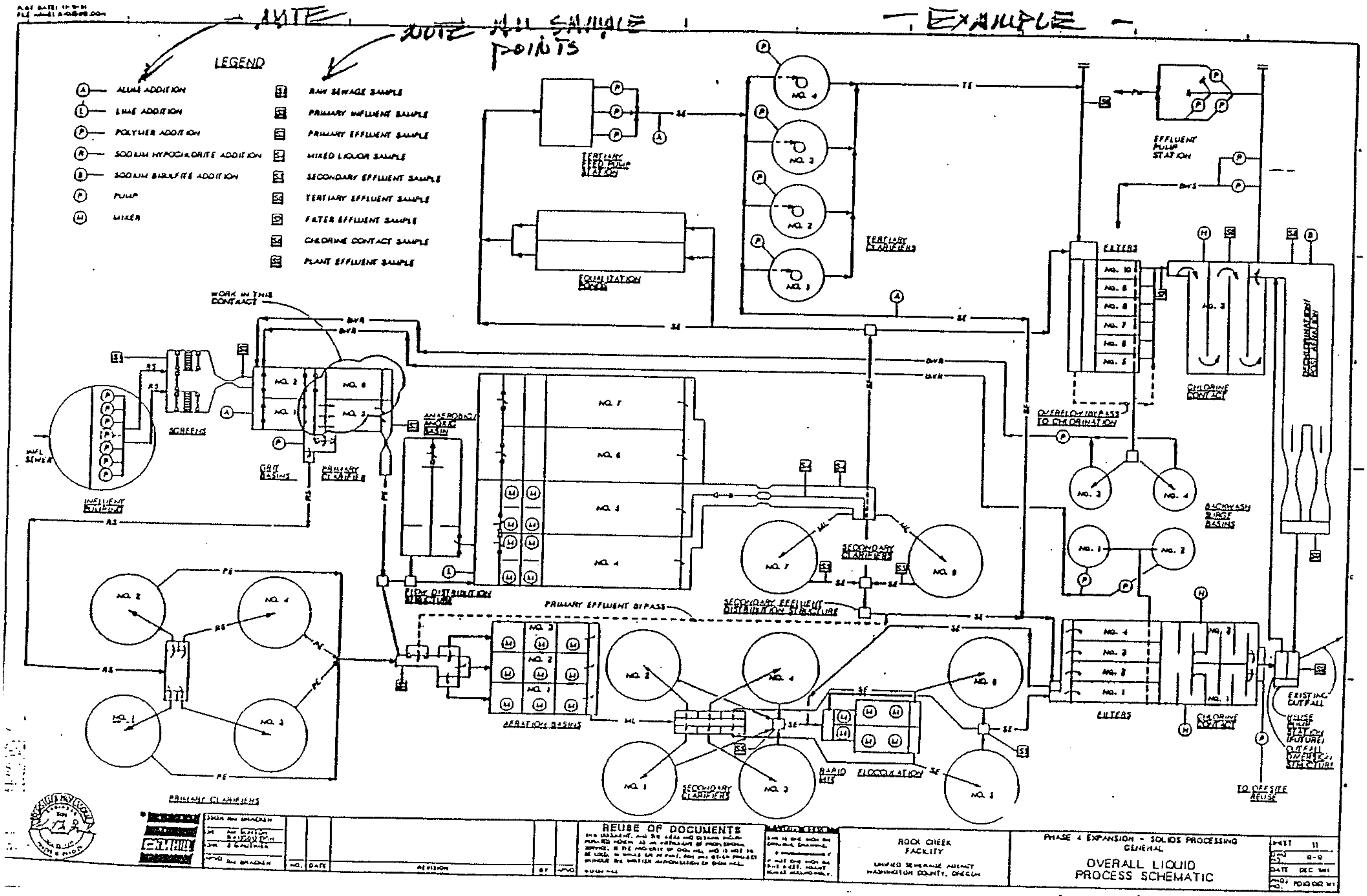
Design Data Summary, Solids and Chemical Processes

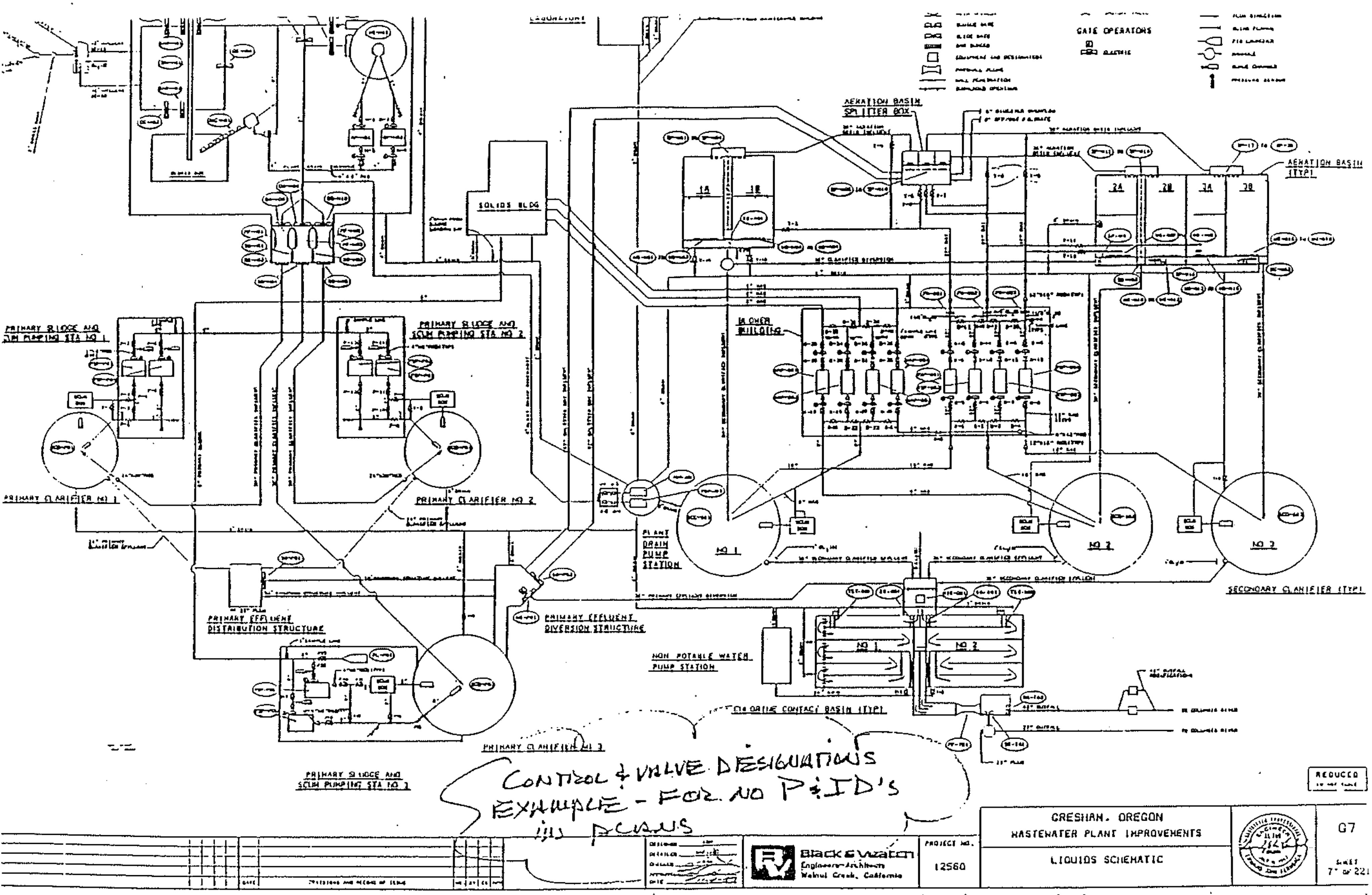


Hydraulic Profile, Secondary Treatment

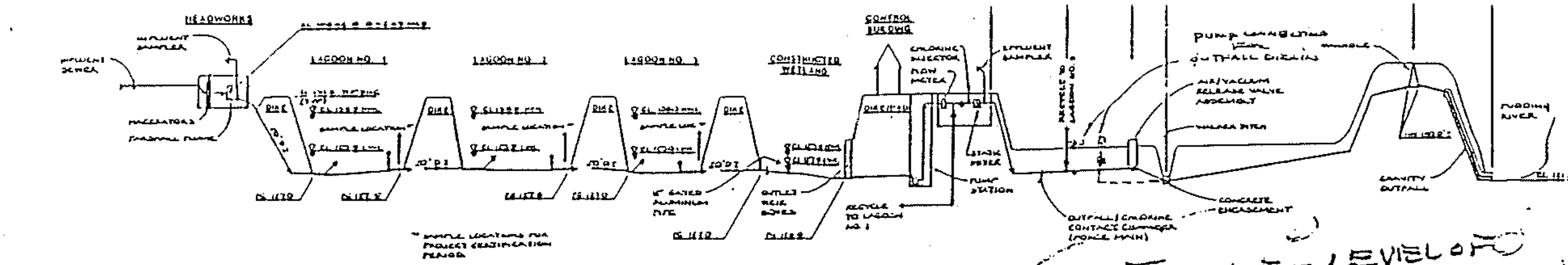


Hydraulic Profile, Advanced Treatment


ANTE
NOTE ALL SAMPLE POINTS
EXAMPLE
LEGEND
ALUM ADDITION
LIME ADDITION
POLYMER ADDITION
SODIUM HYPOCHLORITE ADDITION
SODIUM BISULFITE ADDITION
PUMP
MIXER
RAW SEWAGE SAMPLE
PRIMARY INFLUENT SAMPLE
PRIMARY EFFLUENT SAMPLE
MIXED LIQUOR SAMPLE
SECONDARY EFFLUENT SAMPLE
TERTIARY EFFLUENT SAMPLE
FILTER EFFLUENT SAMPLE
CHLORINE CONTACT SAMPLE
PLANT EFFLUENT SAMPLE
TERTIARY FEED PUMP STATION
EQUALIZATION BASIN
TERTIARY CLARIFIERS
EFFLUENT PUMP STATION
FILTERS
CHLORINE CONTACT
DECHLORINATION/ POST AERATION
WORK IN THIS CONTRACT
INFL. SEWER
INFLUENT PUMPING
SCREENS
GRIT BASINS
PRIMARY CLARIFIER
ANAEROBIC/ ANOXIC BASIN
FLOW DISTRIBUTION STRUCTURE
OVERFLOW/BYPASS TO CHLORINATION
BACKWASH SURGE BASINS
SECONDARY CLARIFIERS
SECONDARY EFFLUENT DISTRIBUTION STRUCTURE
PRIMARY EFFLUENT BYPASS
PRIMARY CLARIFIERS
AERATION BASINS
RAPID MIX
FLOCCULATION
EXISTING OUTFALL
TO OFFSITE REUSE
REUSE OF DOCUMENTS
ROCK CREEK FACILITY
UNIFIED SEWERAGE AGENCY
WASHINGTON COUNTY, OREGON
PHASE 4 EXPANSION - SOLIDS PROCESSING
GENERAL
OVERALL LIQUID PROCESS SCHEMATIC
DATE DEC 1991

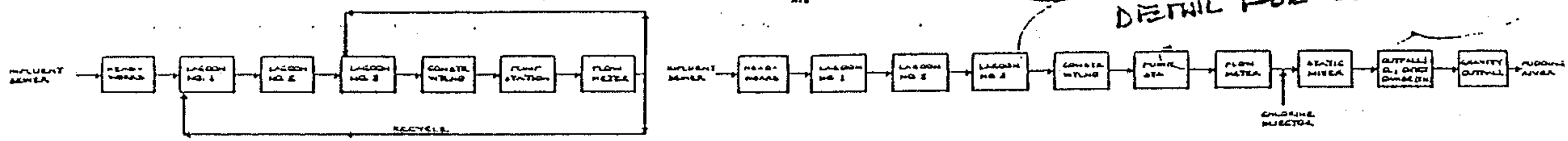


GATE OPERATORS
ELECTRIC
AERATION BASIN SPLITTER BOX
AERATION BASIN (TYP)
1A
1B
2A
2B
3A
3B
SOLIDS BLDG
BLOWER BUILDING
PRIMARY SLUDGE AND SCUM PUMPING STA NO 1
PRIMARY SLUDGE AND SCUM PUMPING STA NO 2
PRIMARY SLUDGE AND SCUM PUMPING STA NO 3
PRIMARY CLARIFIER NO 1
PRIMARY CLARIFIER NO 2
PRIMARY CLARIFIER NO 3
PLANT DRAIN PUMP STATION
NO 1
NO 2
NO 3
SECONDARY CLARIFIER (TYP)
PRIMARY EFFLUENT DISTRIBUTION STRUCTURE
PRIMARY EFFLUENT DIVERSION STRUCTURE
NON POTABLE WATER PUMP STATION
CHLORINE CONTACT BASIN (TYP)
CONTROL & VALVE DESIGNATIONS
EXAMPLE - FOR NO P&ID'S
IN PLANS
REDUCED
GRESHAM, OREGON
WASTEWATER PLANT IMPROVEMENTS
LIQUIDS SCHEMATIC
PROJECT NO.
12560
Black & Veatch
Engineers-Architects
Walnut Creek, California
G7
SHEET
7 of 221



HYDRAULIC PROFILE

NTS



NO DISCHARGE TO SURFACE WATERS

TYPICAL SUMMER OPERATION

NTS

(MAY 1 - OCTOBER 31)

DISCHARGE TO SURFACE WATERS

TYPICAL WINTER OPERATION

NTS

(NOVEMBER 1 - APRIL 30)

WASTEWATER TREATMENT PLANT DESIGN CRITERIA

FLOWS AND LOADINGS

EFFLUENT DISCHARGE RATE TIED TO THE PUDDING RIVER

HEADWORKS

LAGOONS AND CONSTRUCTED WETLAND

DISCHARGE PERIOD

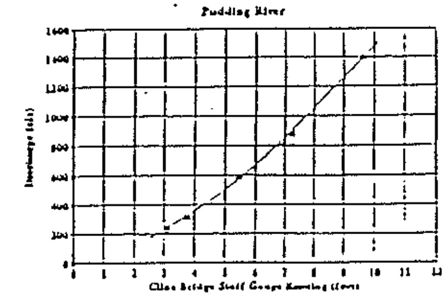
EFFLUENT/RECYCLE FLOW STATION

CHLORINATION FACILITIES

OUTFALL DISCHARGE STRUCTURE

STAGE-DISCHARGE CURVE

Pudding River



CITY OF MT. ANGEL

SEWERAGE SYSTEM IMPROVEMENTS

GENERAL

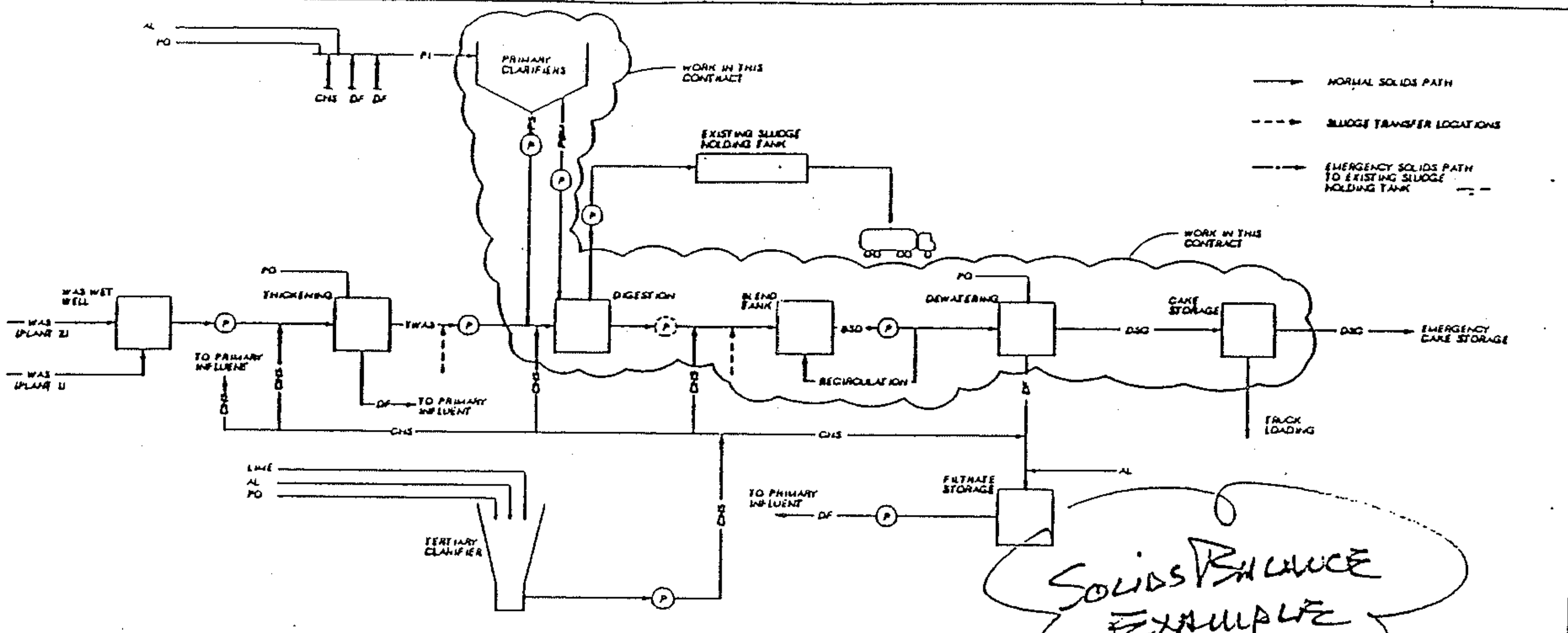
HYDRAULIC PROFILE, DESIGN CRITERIA

WESTECH ENGINEERING, INC.

SHEET 3

JOB NUMB

Lagoon Flow Diagram and Design Data Summary



	1993									1997									2010								
	AVG. DAY DRY			MAX MONTH DRY			MAX. MONTH WET			AVG. DAY DRY			MAX. MONTH DRY			MAX. MONTH WET			AVG. DAY DRY			MAX MONTH DRY			MAX. MONTH WET		
	FLOW (1000 GPD)	TSS lbs/day	CONC %	FLOW (1000 GPD)	TSS lbs/day	CONC %	FLOW (1000 GPD)	TSS lbs/day	CONC %	FLOW (1000 GPD)	TSS lbs/day	CONC %	FLOW (1000 GPD)	TSS lbs/day	CONC %	FLOW (1000 GPD)	TSS lbs/day	CONC %	FLOW (1000 GPD)	TSS lbs/day	CONC %	FLOW (1000 GPD)	TSS lbs/day	CONC %	FLOW (1000 GPD)	TSS lbs/day	CONC %
PLANT INFLUENT (MGD)	16.6			17.1			27.2			17.4			18.1			41.6			23.3			31.6			46.0		
PRIMARY SLUDGE	100	30,843	4.6	106	41,106	4.0	78	28,204	5.6	111	37,287	4.6	161	44,636	3.6	70	32611	5.0	146	48,485	4.0	201	60,064	3.6	104	43,806	5.0
WASTE ACTIVATED	202	10,046	0.6	222	1088	0.6	248	12,262	0.5	223	1040	0.6	247	12,377	0.6	276	13,765	0.6	210	14,010	0.6	301	16,656	0.6	271	18,544	0.6
CHEMICAL SLUDGE	26	2043	1.0	43	2578	1.0				44	2654	1.0	48	2884	1.0				48	4860	1.0	64	4216	1.0			
THICKENED WAS	20	9613	6.0	22	10,893	6.0	24	11,834	6.0	22	10,636	6.0	24	12,046	6.0	27	13,246	6.0	30	14,600	6.0	32	16,119	6.0	36	18,066	6.0
DAT FILTRATE	232	204	0.016	250	324	0.016	271	346	0.016	253	336	0.016	273	373	0.016	240	414	0.017	230	442	0.017	340	498	0.017	204	564	0.017
DIGESTED SLUDGE	100	25,453	3.07	107	26,041	3.62	84	23,232	3.23	133	32,873	2.97	175	41,156	2.81	106	28,240	3.23	227	60,920	2.97	248	62,524	3.01	162	48,566	3.23
DEWATERED SLUDGE	22	27,366	15	26	34,564	15	18	23,104	15	25	31,034	15	31	38,156	16.0	21	26,731	15	46	57,663	16.0	66.0	82,574	15.0	52.1	65,124	15.0
BELT PRESS FILTRATE	215	1761	0.10	237	2232	0.11	182	1526	0.1	216	3417	0.11	253	3487	0.12	182	1906	0.11	776	8415	0.12	744	4454	0.07	545	3454	0.12
SEPTAGE	6	1501	3.0	6	1501	3.0	6	1501	3.0	6	1501	3.0	6	1501	3.0	6	1501	3.0	6	1501	3.0	6	1501	3.0	6	1501	3.0

NOTES:

AVERAGE DAY DRY • PHOSPHOROUS REMOVAL TO 0.15 mg/l WITH COMBINATION BNR AND ALUM

MAX MONTH DRY • PHOSPHOROUS REMOVAL TO 0.15 mg/l WITH ALUM ONLY

MAX MONTH WET • NO ALUM ADDITION DURING WET WEATHER PERIOD

CH2M HILL

NO. | DATE | REVISION | BY | APVD

REUSE OF DOCUMENTS

ROCK CREEK FACILITY

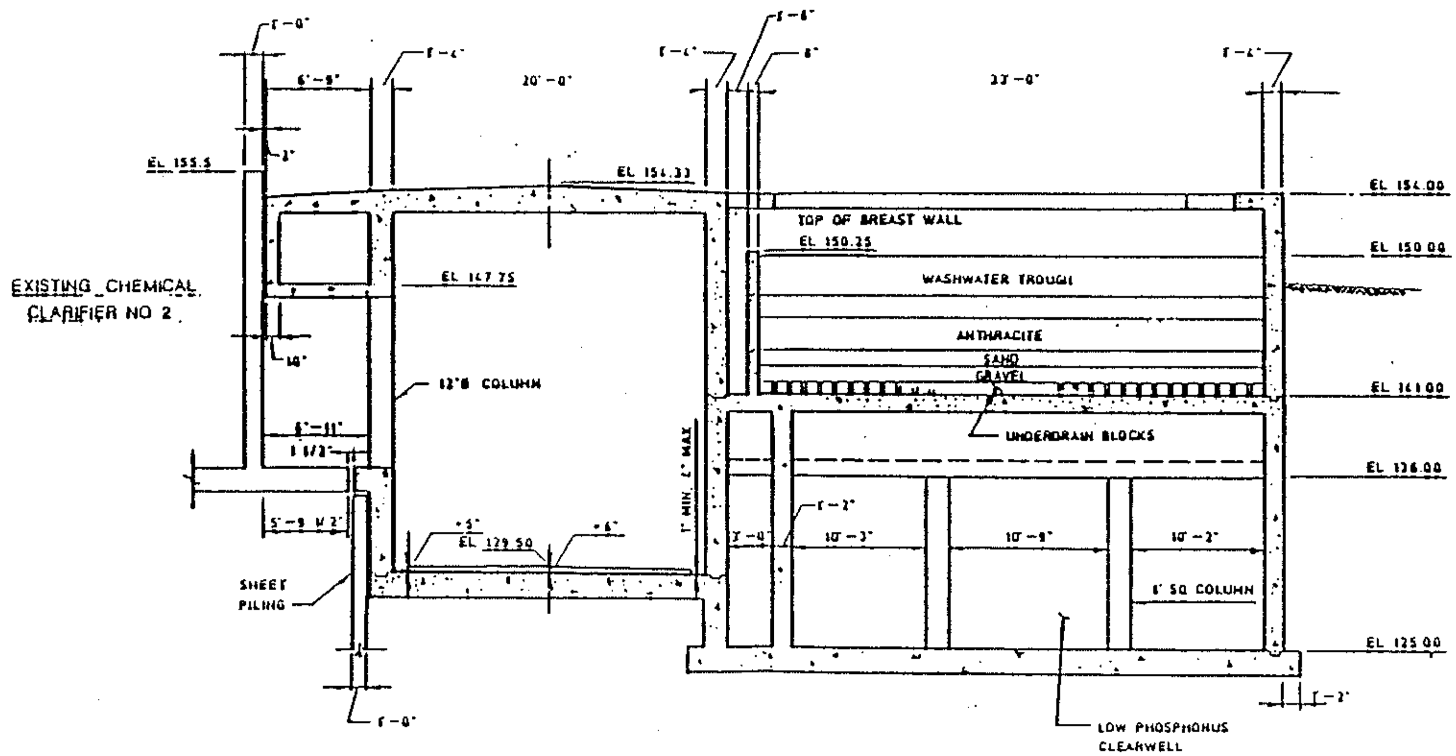
UNIFIED SEWERAGE AGENCY
WASHINGTON COUNTY, OREGON

PHASE 4 EXPANSION - SOLIDS PROCESSING
GENERAL

SOLIDS BALANCE DIAGRAM

SHEET 10 | DATE DEC 1991

Solids Balance Diagram



SECTION A

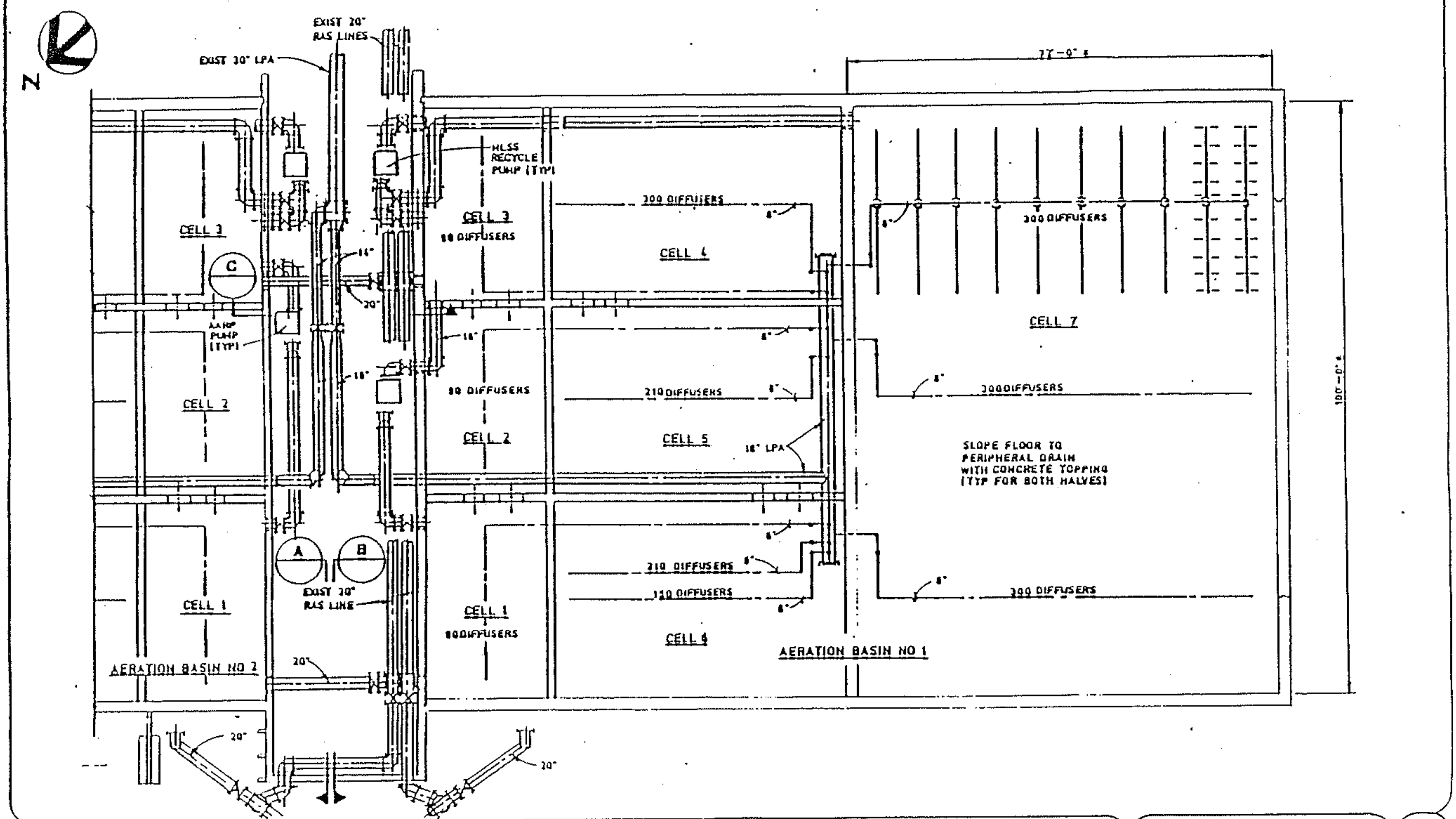
FILTERS-SECTION

HDR
HDR ENGINEERING INC.

USA DURHAM PLANT
PHASE I A

FIGURE 4.23

. Outline Section



AERATION BASIN MODIFICATIONS-SECTIONAL PLAN

HDR Engineering Inc.

USA Durham Plant Phase I B

Figure 4.4

Outline Plan