Appendix F

City of Anderson
Septage Lagoon Operations Manual

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Part I. FACILITY DESCRIPTION

(See "Anderson Septage Lagoon Site Plan")

Primary Cell - Freeze/thaw Beds

The east and west primary cells are located on either side of the facultative cell. Each cell is lined with LTA pvc (Low Temperature Arctic polyvinyl chloride) impermeable liner.

Septage pumpers discharge septage directly into the primary cells. The foremost function of the primary cells is to allow solids to settle out of fresh septage.

Both the east and west primary cells have a sandy-gravel drain bed which is used to freeze/thaw condition sludge. The freeze/thaw beds are a reverse drainfield of sorts; perforated HDPE (high density polyethylene) pipe were lain at 10 feet on centers covered by 24 inches of sandy gravel.

Freeze/thaw bed floor area: **140 ft x 43 ft, 6000 sq ft**
Freeze/thaw cell depth (from top of drain bed to 1 foot freeboard line): **5.5 feet**
primary cell liquid holding capacity with 1 foot freeboard: **450,000 gals**
Sludge storage capacity (2 foot depth): **13,000 cu ft**

Primary cell liquid is either pumped or siphoned to the facultative cell, depending on the respective liquid level of the primary and facultative cell. See "Operations Descriptions" section for liquid transfer details.

Old Primary Cell

After construction of the primary cell - freeze/thaw beds, the old primary cell was put out of use. The old primary cell had filled up with solids.

Primary Cell depth: **9.8 ft**
Interior dike slope: **3:1**
Cell floor area: **35 ft x 105 ft = 3675 s.f.**
Effluent pipe height above cell floor: **3.2 ft** (to invert)
Impermeable lining: **28 mil LTA PVC**

Some sludge was transferred to the primary cell - freeze/thaw bed. Winter freeze further consolidated the sludge level in the old primary cell.

The old primary cell <u>could recieve</u> fresh septage in a pinch. It may be used as contingency in the event either the east or west primary cells is full and a pumper need discharge septage.

Liquid Transfer Pump/valve manifold

(See "Primary Cell to Facultative Cell Liquid Transfer Facilities".)
(See "Liquid Transfer Pump/valve Manifold".)

A pump/valve manifold enables liquid transfer from the primary cell/freeze-thaw beds to the facultative cell.

If the freeze thaw bed liquid level is sufficiently high, liquid transfer can be initiated by opening the main 4 inch gate valve between the cells. As the water level drops, the bulk of the liquid is transferred by siphon.

In most cases the liquid level of the primary and facultative cells will allow a siphon, but can not establish flow by turn of a valve. The pump/valve manifold permits a pump to be hooked up in parellel with the 4 inch liquid transfer pipe. Once flow through the pump is initiated, a siphon can be easily established. (See "Liquid Transfer, Primary Cell to Facultative Cell", in Operations and Maintenance Section.)

Where liquid level in the facultative cell is above the liquid level in the primary cell, liquid transfer can only be accomplished by pumping.

Six inch ductile iron pipe connects the old primary cell to the facultative cell and the facultative cell to the percolation cell. A valve in each controls discharge. A manhole with an adjustable weir serves as a cleanout and allows control of the energy of the effluent from either cell.

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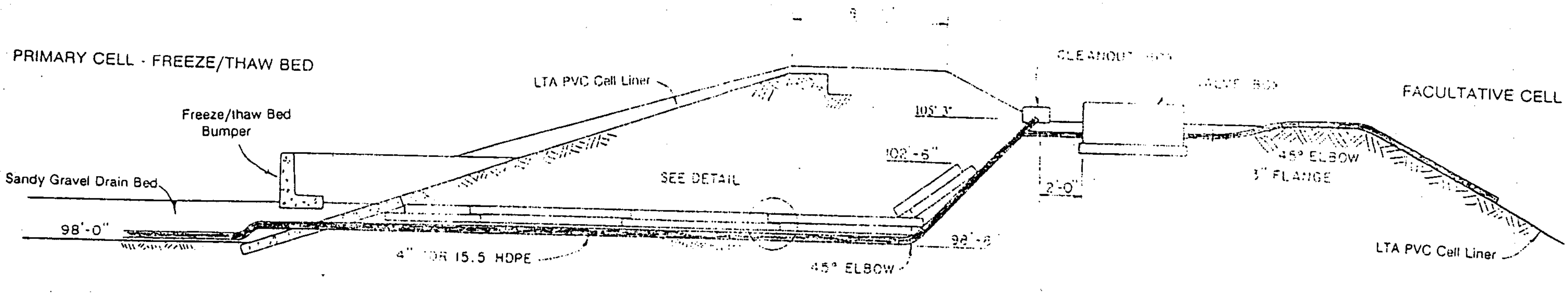
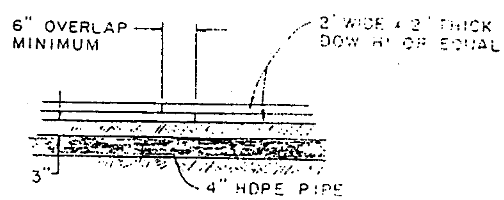
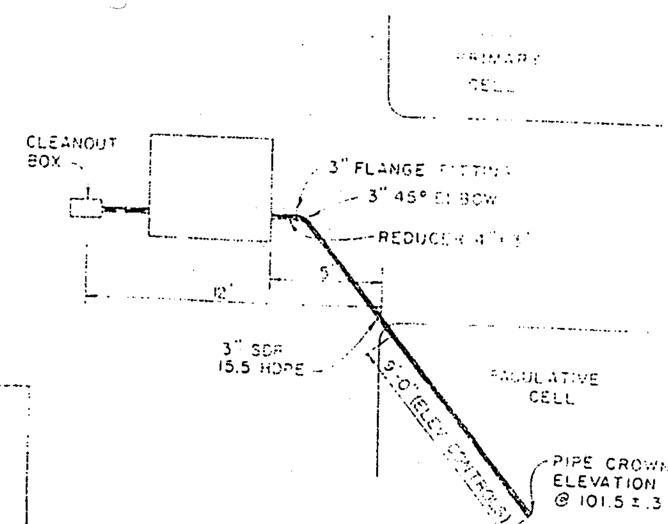


PROFILE

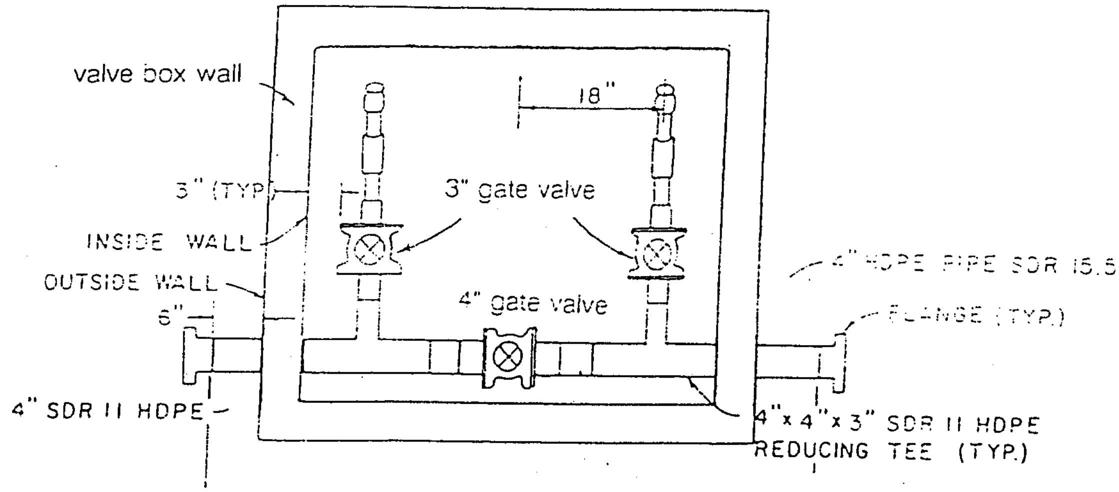


Insulation Detail



PLAN

Detail of
PRIMARY CELL to FACULTATIVE CELL
LIQUID TRANSFER FACILITY
Anderson Lagoon

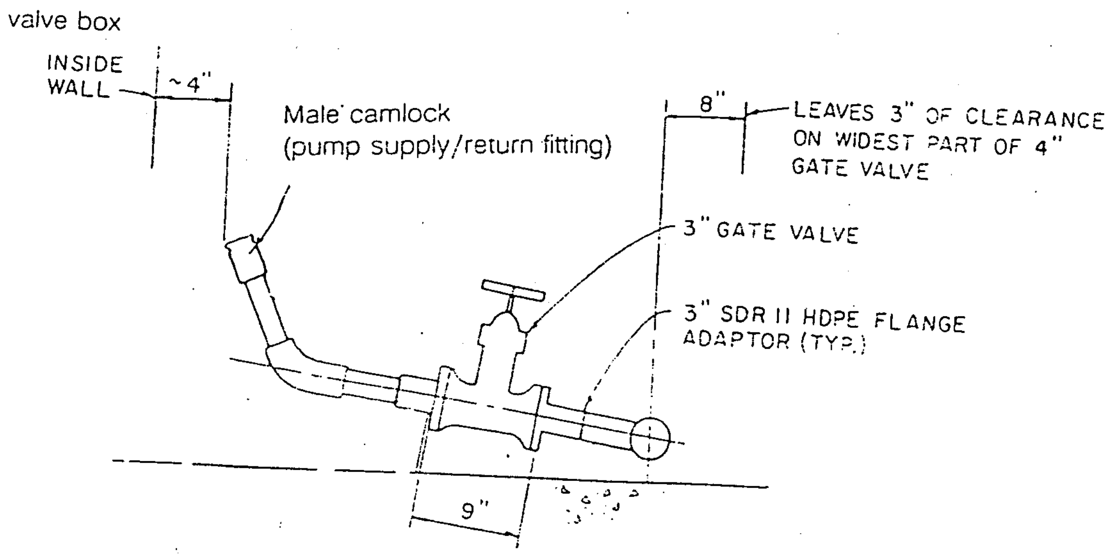


Liquid Transfer
Pump/Valve Manifold
Plan

VALVE SPEC

2 EA. 3" RESILIENT SEAT GATE VALVE MEETING AWWA C509
- NON-RISING STEM
- FLANGED ENDS FOR 150 PSI (4 EA. 3/4" BOLTS)
- WITH HANDWHEEL

1 EA. 4" RESILIENT SEAT GATE VALVE MEETING AWWA C509
- NON-RISING STEM
- FLANGED ENDS FOR 150 PSI (8 EA. 3/4" BOLTS)
- WITH HANDWHEEL



Pump/Valve Manifold
Elevation

Note: Pump/valve manifold is shown tilted 15° per plan specification. Manifold was constructed horizontal, and 90° elbow put in ahead of the male camlock pump supply/return fitting.

Facultative Cell Description

After pretreatment in the primary cells, septage liquid is transferred to the faculatative cell. The facultative cell provides treatment needed prior to discharge to the percolation cell. Facultative cell treatment reduces BOD, nitrogen, and pathogens to levels required by the wastewater discharge permit.

Facultative Cell depth: 9.8 ft
Interior dike slope: 3:1
Cell floor area: 95 ft x 95 ft = 9025 s.f.
Effluent pipe height above cell floor: 3.5 ft (to invert)
Impermeable lining: 28 mil LTA PVC
active volume or holding capacity (with 1.0 ft freeboard): **720,000 gallons**

The facultative cell discharge pipe is 3.5 feet above the cell floor. Water below the discharge pipe is not discharged to the percolation cell during the annual discharge, but remains in the facultative cell. This volume is 295,000 gallons (or about 39,000 cubic feet).

Percolation Cell Description

The purpose of the percolation cell is to discharge lagoon liquid to the ground. The percolation cell floor consists of 6 in of sandy silt over 6 in of clean sand. The sandy silt liner slows an otherwise rapid discharge. This improves ground water dilution of any remaining BOD, nitrates and ammonia in the lagoon effluent. It also filters considerable algae.

Percolation cell depth: 7.8 ft
interior dike slope: 1:3
cell floor area: 85 ft x 50 ft = 4250 s.f.
influent pipe height above cell floor: 2.5'

Sludge Disposal Cell

Freeze/thaw conditioned sludge is removed from the primary cells/freeze-thaw beds and disposed in the sludge disposal cell. The cell is constructed of pit run gravel (gravelly sand) on geofabric over a silt layer. The geofabric over silt layer is contoured to drain liquid to the percolation cell. The floor of the cell is level and constructed of pit run gravel so rain fall or snowmelt does not accumulate within the sludge disposal cell, which purpose is to reduce liquid contact with disposed sludge to avoid generation of leachate.
Sludge is disposed by encapsulating it within a silt layer. A layer of silt is put down over and under the sludge deposited in the cell. The silt is then seeded with native seed mix or grass seed.

The sludge disposal cell life is estimated at 20 to 30 years.

Groundwater

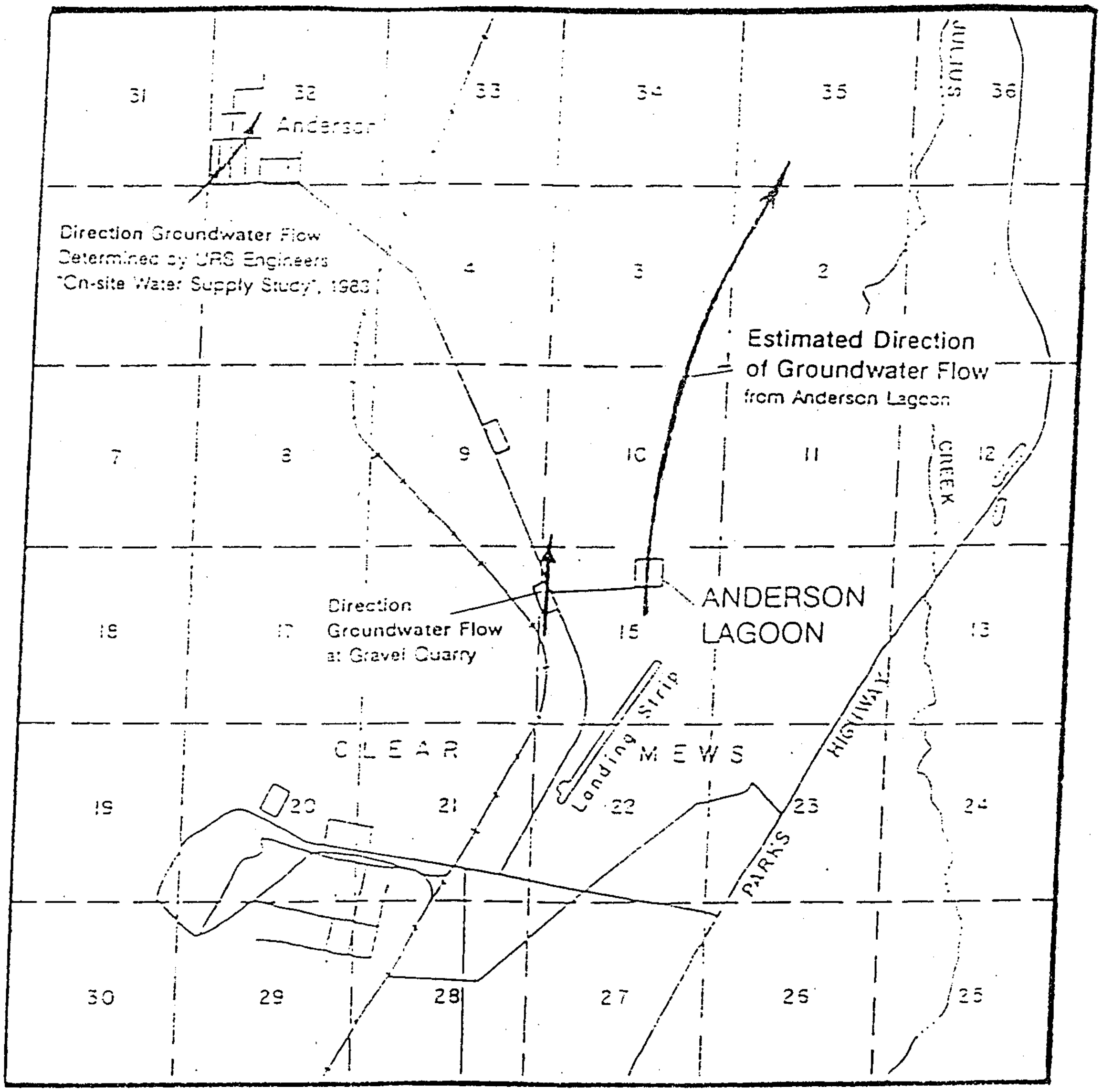
The groundwater table is over four feet below the percolation cell floor grade. This was checked over several years. Generally, the water table was at the 88 feet elevation, based on an assumed elevation of 100 feet at the top of the lot southeast corner monument. The water level fluctuates and rose to 90.5 feet during Summer 1992. According to residents this was a very high water table. Problems with gravity flow to septic tank drainfields was not uncommon.

The percolationn cell floor is at 94.8 feet grade. The lowest point of the lagoon is 94.4 feet. which is the facultative and primary cell floor elevation (elevation based on above said local assumed elevation).

The groundwater flow direction is north by northeast as shown in attached " Anderson Septage Lagoon Vicinity Map Showing Direction of Groundwater Flow". The direction was determined from "Evaluation of On Site Water Supplies", a study by URS Engineers done in 1983. That study determined the groundwater flow direction in the City of Anderson. Groundwater flow from the Anderson lagoon travels in a direction which is oblique to the direction of the City. Discharge from the lagoon would be carried a considerable distance east of the city.

Average
Highest

Lowest 6.40
12.0



ANDERSON SEPTAGE LAGOON

VICINITY MAP
SHOWING DIRECTION OF GROUNDWATER FLOW

Part II. OPERATIONS AND MAINTENANCE

Object

The object of operations and maintenance can be summarized as follows:

1. Provide access and septage discharge facilities to septage pumpers;

2. Provide adequate treatment prior to discharging liquid to the ground:

3. De-water, remove, and dispose sludge:

4. Comply with ADEC permit requirements.

Operational schedule

The Anderson lagoon is generally operated on an annual cycle or schedule.

Annually, in the Fall, liquid is transferred from the primary cell to the facultative cell. Give or take a month, detention time of liquid in the facultative cell is one year.

Annually, the lagoon is discharged (liquid is discharged from the facultative cell to the percolation cell).

Annually, in the Fall, access to one of the primary cells is blocked so it may serve to freeze/thaw condition sludge.

SCHEDULE of LAGOON OPERATIONS

Date	Operation or Activity	Detail or Comment
Sept - Oct	1. Discharge treated lagoon water; that is, discharge the facultative cell to the percolation cell.	a. Determine depth in facultative cell before the discharge. b. Discharge on Tues, Weds, or Thrs, so lab can run 5-day BODs.
Sept - Oct	1. Collect sample of the discharge liquid. Collect four (4) part composite sample. Sample as water exits the discharge pipe. 2. Deliver samples to lab in Fairbanks. Have lab do test for BOD, fecal coliform, and suspended solids.	Put samples on ice during sampling and in transit to Fairbanks. Deliver to lab within 24 hours.
Sept - Oct	1. Report test results, date, and volume of lagoon discharge to ADEC. 2. File the same information.	
Sept - Oct	**after facultative cell discharge** 1. Transfer east[1] (or west) primary cell liquid to facultative cell.	
Winter	1. Remove snow and maintain access.	
May - June	1. Pump off any liquid remaining in the east[1] (or west) primary cell freeze/thaw bed. (liquid is from snowmelt or sludge de-watering.) 2. Transfer the remaining liquid to the old primary cell.	Use the jet thaw unit to clear the liquid transfer line if it is still frozen in June.
June	1. Sample sludge. Collect three (3) part composite, three shovelfuls. 2. Test sludge for arsenic, chromium, nickel, total solids, percent solids, and fecal coliform.	Bag and box sample and keep it cool. Deliver sample to lab within a day.
June - July	1. Confirm that metals testing results does not exceed pollutant limits.	
June - July	1 pump off any remaining liquid from the primary cell before driving sludge removal equipmpent on the drain bed. 2. Remove sludge from primary cell freeze/thaw bed and dispose in sludge disposal cell. 3. Make time to cover sludge at end of working day with 6 inches of silt loam. This is part of permit.	Put layer of silt loam over and under sludge. D-3 dozer and loader may be used to remove sludge. Do not use the D-7 dozer in side the primary cell or the liner may be damaged.
July	1. Report tests and date and volume of sludge disposal to ADEC.	
Sept - Oct	Repeat sequence. Change which primary cell.	Seed sludge cover with grass or plants.

1. The East and West primary cells serve as sludge freeze/thaw beds in alternating years, so one year this is the "East" primary cell, the next, it is the "West" primary cell.

1. Facultative Cell Discharge

When: Annually, during late August or early September. Schedule discharge for any day Tuesday through Thursday so samples can be delivered to lab before noon on Friday.

How: Open the valve between facultative cell and percolation cell. Operation requires a long stem valve key.

Close the valve after the water level drops to the invert of the discharge pipe, when the discharge is complete.

2. Lagoon Discharge Sampling and Testing

Test Parameters

Lagoon Discharge Testing and Equipment Summary

Test parameter	Equipment
BOD_5	1 ea 500 milliliter bottle
total suspended solids	1 ea 500 milliliter bottle
Fecal coliform	1 ea sterilized bottle
	1 ea 500 milliliter bottle - extra
	1 ea cooler - for sample transport

Equipment and Lab Time

a) Sample Kit - Order or pick up sample bottles and cooler itemized above from Northern Test Labs (NTL) in Fairbanks.

Northern Testing Laboratories, Inc.
3330 Industrial Avenue
Fairbanks, AK 99701

Contacts: Jim Johnson
Cindy Christian

phone: 456-3116
fax: 456-3125

Tell NTL you are doing Anderson Lagoon Discharge sampling and testing.
Tell NTL when you plan to collect the sample and when you will deliver it.

b) Sample day-of-week - Sample should be delivered on Tuesday, Wednesday, Thursday, or by noon on Friday. **Plan the lagoon discharge for Tuesday, Wednesday, or Thursday.** The 5-day BOD is usually started on Weds., Thurs., or Fri. so it does not end on weekend, which avoids overtime and an extra expense. The lab may store it for 24 hours if it is delivered on Tuesday.

Lagoon Discharge Sampling

Collect 3-part composite from the facultative cell discharge stream. Use a large sample bottle to collect liquid from the discharge stream then pour liquid in the sample bottles. Fill sample bottles 1/3 full at the begining of discharge. Two (2) to four (4) hours later, fill sample bottles to 2/3 full . Top off the sample bottles another 2 to 4 hours later.

Keep samples on ice during sampling and delivery to Fairbanks.

Deliver samples to NTL the next day.

Measure Discharge Volume:

a) Find Depth (d)

option 1) - Measure depth (d) directly from a raft. Use a rod or tape to measure depth of water in the faculative cell.

or

option 2) - Determine grade of the top of water using a level instrument. The South east lot corner monument is 100.00 feet elevation. Accordingly, the faculative cell floor elevation is 94.4 feet.

Subtract the cell floor elevation from top of water elevation to find depth (d):

Depth (d) = top-of-water grade - 94.4 feet (cell floor grade)

b) Find Discharge Volume The waste water permit requires that the annual discharge volume be reported. The discharge volume is calculated from the depth of the facultative cell before the annual discharge.

The formula to calculate the volume of liquid above the facultative cell discharge pipe invert is as follows:

Lagoon (or facultative cell) Discharge Formula
discharge volume (d) = $[9025(d) + 570(d)^2 + 9(d)^3] - 39{,}000$
where: volume is in cubic feet depth, d (feet), is water depth in facultative cell
to convert to gallons, multiply volume by 7.48.

The total volume of liquid within the facultative cell, from the cell floor to the water surface is:

$$[9025(d) + 570(d)^2 + 9(d)^3]$$

The discharge volume is found by subtracting 39,000 cubic feet from the total volume. This is the volume below the discharge pipe and remains in the facultative cell even when the discharge valve is open.

Example: Find volume of liquid discharged from the facultative cell if the water depth before the discharge is 6'3".

a) Convert 6'3" to 6.25'. d = 6.25 feet. Plug this into formula for active volume (above).

b) discharge volume $= \{[9025(6.25) + 570(6.25)^2 + 9(6.25)^3] - 39{,}000\}$ cu ft

$= 80{,}870 - 39{,}000 = 41{,}870$ cu ft

c) convert volume in cubic feet to gallons: 41,870 x 7.48 = 313,187 gallons which rounds to **313,000 gallons**

Note: Round discharge volume to nearest 1000 gallons. The computed precision of discharge is no better than this.

Report and File Test Results and Discharge Information:

a) Submit the testing results and discharge date and volume information to ADEC:

State of Alaska
Department of Environmental Conservation
Regional Wastewater Program Manager
1001 Noble Street, Suite 350
Fairbanks, Alaska 99701-4980

Phone: 451-2360

b) File a copy of test results and the discharge date and volume information.

3. Liquid Transfer, primary cell to facultative cell

General: In alternate years, each primary cell serves as a freeze/thaw bed to condition sludge prior to removal. After liquid transfer, access to this cell is barricaded.

In fall, transfer liquid from the primary cell - freeze/thaw bed to the facultative cell. Transfer liquid in the fall after the lagoon discharge.

Transfer all of the liquid which can be pumped or siphoned (removed) from the East or West Primary Cell whichever has been receiving septage during the last year. This improves freeze/thaw conditioning.

In the spring, after sludge and snow have thawed, transfer remaining liquid to the old primary cell.

Note: In the fall, after the lagoon discharge, transfer old primary cell liquid to the facultative cell before the East or West primary cell liquid transfer is conducted.

Old Primary Cell Liquid Transfer: In the fall, after the facultative cell discharge, open the valve between the old primary cell and the facultative cell. After a day or so, the water level of the old primary cell and the facultative cell will come to same elevation.

Close the valve between the facultative cell and old primary cell after the respective water levels become the same.

If it is desirable to lower the old primary cell liquid further, set up the centrifugal pump between the old primary cell and the east or west primary cell. Pump liquid from the old primary to whichever primary cell has unconditioned sludge.

East or West Primary Cell Liquid Transfer: Liquid may be siphoned or pumped from the east or west primary cell to the facultative cell.

See the "Detail of PRIMARY CELL TO FACULTATIVE CELL LIQUID TRANSFER FACILITIES" and "LIQUID TRANSFER PUMP/VALVE MANIFOLD" figures. These figures are in *PART I: Facilities Description* Section of this O&M Manual.

In the Fall, the water level of the east or west primary cell (whichever has been receiving septage) is higher than the facultative cell. This enables a liquid transfer by siphon.

In the Spring, it is probable that liquid will need be pumped from the east or west primary cell - freeze/thaw bed to the old primary cell.

Pumping Liquid:

a) The centrifugal pump is attached to the pump/valve manifold;
b) The 4 inch valve is closed and the 3 inch valves are open;
c) The pump is primed and fired and flow established;
d) Periodically check fuel level during pumping operation.

Siphon Liquid:

a) Start pumping operation and establish pumping flow (above);
b) Open the 4 inch valve;
c) Cut the pump and close the 3 inch valves.

Measure and Record Liquid Transfer Volume (OPTIONAL):

a) Measure the depth of the faculative cell BEFORE and AFTER the liquid transfer.
b) Calculate the before and after volumes. Use the facultative cell volume formula. See page 6, under "Facility Description" for volume formula.
c) The volume after the transfer minus the volume before the transfer is the liquid transfer volume.
d) Log and file the liquid transfer volume and in the lagoon operations log. File before and after depth of water.

Clearing Frozen Liquid Transfer Line: Some part of the liquid transfer line may freeze, in which case, it will thaw last. The liquid transfer line is full for most of its 40 foot length under the berm. Though it is covered with four inches of polystyrene insulation board, some portion adjacent the freeze-thaw bed may very well freeze.

A pressure "jetter" has been provided to the City to clear the liquid transfer line if it is still frozen by June. See appendix for the *General Jet Set* operating instructions.

4. Sludge Disposal Operations

The Anderson Lagoon east and west primary cells receive septage in alternating years. At the end of a receiving year, liquid is siphoned from the east or west primary cell (whichever has been receiving septage during the year) to the facultative cell.

Sludge Freeze/thaw conditioning: Sludge conditioning consists freezing and thawing the drained sludge. All liquid is evacuated from the primary cell in the fall. So called "drained" sludge remains on the freeze/thaw bed. The freeze/thaw process which occurs during the subsequent winter and spring forces the bulk of remaining liquid from sludge.

In the following spring, snowmelt and sludge liquid in the freeze thaw bed is pumped off.

Warning: Before any sludge removal equipment is allowed to operate on the sludge bed, all free liquid must be pumped from the freeze/thaw primary cell. The bearing strength of the drain bed is seriously reduced if all or part of the drain bed is saturated. Sludge removal equipment may damage the liner if free liquid is not removed from the drain bed.

A pressure "jetter" has been provided to the City to clear the liquid transfer line if it is still frozen by June. See appendix for the *General Jet Set* operating instructions.

Sludge Removal: After snowmelt and sludge liquid is transferred after thaw, allow the sludge to dry for a week or so. Then remove the sludge and dispose within the sludge disposal cell. Within the sludge disposal cell, encapsulate the sludge in a layer of silt loam.

Use the light dozer, Cat D-3, to doze sludge to the access end of the primary cell. Use the City loader to move sludge to the sludge disposal cell or haul sludge in the end dump.

Sludge Disposal: Put down a six (6) inch layer of silt where the sludge is to be disposed within the sludge disposal cell. A base area of about 20 x 30 feet against the berm, or adjacent last year's covered sludge, is enough for a two feet layer of annual sludge volume.

Deposit the conditioned sludge on top of the silt covered base area within the sludge disposal cell. Use the light dozer to spread sludge in a two (2) to three (3) feet deep layer.

Apply a 6 inch layer of silt loam over the sludge. Finish the edges of the sludge pile and cover with 2 to 1 slope. The sludge pile side slopes are also to be covered with silt. Seed the covered sludge pile with grass or other seed mix in the fall.

Pathogen and Vector Attraction Control: Cover the sludge at the end of the working day with 6 inches of material to keep out birds, rodents and insects. "Cover at the end of the working day" is a condition of the permit.

The seed and consequent grass and plants are intended to transpire rainfall or snowmelt liquid. The silt loam cover is intended to reduce liquid infiltration into the disposed sludge.

5. Sludge Sampling and Testing

The sludge disposal permit requires sludge testing. Annually or when sludge is disposed in the sludge disposal cell, sludge must be sampled and tested. The following table lists the required tests.

Sludge Testing Schedule: Sample and test the conditioned sludge in May or June, prior to the scheduled sludge disposal in June or July. Sample the sludge after the sludge supernatant has been transferred to the facultative cell.

Sludge Tests:

parameter	units	method
Arsenic	mg/dry kg	EPA 7060
Chromium	mg/dry kg	EPA 7191
Nickel	mg/dry kg	EPA 6010
Total Solids	mg/l	SM[1] or EPA 160.3
Percent Solids	%	SM or EPA 160.3
Total Volatile Solids	%	SM or EPA 160.4
Fecal Coliform	#/dry gram	MPN, SM 9222C

1: SM = Standard Methods

Pollutant Limits: The following pollutant limits for heavy metals are set by the ADEC permit:

Arsenic	30 mg/dry kg
Chromium	200 mg/dry kg
Nickel	210 mg/dry kg.

Compare the test results with the pollutant limits. If heavy metals concentration in the sludge does not exceed the permit pollutant limits, sludge disposal can proceed.

Sludge Sampling Procedures

Sample the drained conditioned sludge for sludge testing purposes. The sampling method is stipulated by the sludge disposal permit.

A 3-part composite sample of the conditioned sludge shoule be obtained. Sample collection points will be at the base of the freeze/thaw bed bumper opposite each septage discharge culvert and adjacent that culvert which has seen the most use during the previous septage discharge year (where sludge is deepest). A shovelful will be obtained from each sample point.

Mix the three grab samples. Put the grab samples on a plywood sheet or in a wheelbarrow mix thoroughly.

Bag, box and deliver the composite sample to Northern Test Labs. Keep the sample cool. Deliver the sludge sample to the lab within a day.

Determining sludge volume: This procedure is for finding volume of conditioned sludge as it is in place in the primary cell freeze/thaw bed. Because of compaction, the disposed volume is considerably less.

Measure the depth of the sludge at seven points around the perimeter of the freeze/thaw bed bumper, three depths on either side and one on the end opposite the cell access. Record the sludge depths.

The sludge volume is the product of the average sludge depth and the freeze/thaw bed floor area. The freeze thaw bed floor area is 5600 square feet.

Reporting

Report the sludge testing results and the sludge volume to ADEC sludge disposal authority. The ADEC Solid Waste Program is over sludge disposal. This is different from the wastewater discharge authority, though both are ADEC. Report the date of the sludge disposal operation.

State of Alaska
Department of Environmental Conservation
Regional Solid Waste Program Manager
1001 Noble Street, Suite 350
Fairbanks, Alaska 99701-4980

Phone: 451-2360

The report will be accompanied by a statement of certification that the sludge disposal operation complied with the sludge disposal permit requirements. Director of Public Works (or his representative) signs.

Recordkeeping

Sludge disposal records will be kept for a minimum of five (5) years.

6. ACCESS AND SITE MAINTENANCE

Annually, after Spring breakup, re-grade the site access.

Inspect the dump station platforms periodically. Fill with pit run and grade as needed.

Clear weeds from around the cells annually. Be careful to protect the liner.

Watch for borrowing rodents, squirrels, etc. If observed, get rid of them; they may gnaw through the liner of any cell.

PATHOGEN PROTECTION PROCEDURE
while working around septage or sludge

1. Wear protective gear.

   A. When pumping saturated sludge or moving freeze/thaw conditioned sludge, WEAR:

      raincoat
      rainpants
      rubber boots
      rubber gloves
      hat
      dust mask
      goggles

   The dust mask and goggles are protection from splashing. Pathogens found in septage are water borne, they exist in liquid, and are not air borne.

   B. Use rubber boots and gloves for collecting samples or other minor contact.

2. Use Common Sense.

   HYGIENE - Don't smoke or comb your hair or scratch your eye or etc. while wearing protective gloves and clothing.

   USE BUDDY SYSTEM whenever working around deep water.

3. Worker Cleanup

   A. Rinse protective gear.
   B. Apply germicide, pinequat, to protective gear (optional);
      2 oz pinequat per gallon water,
      apply with sponge, rag, or spray bottle.
   C. Remove protective gear and put away.
   D. Wash hands thorougly using microbial soap.
   E. Shower.

Notes.

- Protective gear [illegible] is available at Alaska Industrial Hardware, in Fairbanks.
- Germicide [illegible] Antibacterial soap are available at Asplund Supply, Fairbanks.

[illegible] Bud [illegible] Thawing [illegible] and Anchorage [illegible] conducted during the course of drawing up this [illegible]ure.