Peterson Creek Watershed Protection and Assessment

Project Report

Mendenhall Watershed Partnership

Prepared for:
State of Alaska
Department of Environmental Conservation
Division of Air and Water Quality
Non-Point Source Water Quality Program

ACWA Grant 05-12

Introduction

ACWA Grant 05-10 requires a final report that evaluates the project accomplishments and benefits. Tasks 2 and 3 in the grant work plan describe an assessment with baseline data and a Watershed Assessment Report as deliverable products from this assessment study. MWP includes these three elements into this document as an integrated final submission to DEC under the provision of the grant.

Project Accomplishments and Benefits

Project accomplishments from this study are:

1. Joint MWP and DEC Pederson Hill Creek Reconnaissance, 12/3/2004, established sample sites and confirmed stream tributaries and flow patters. (Attachment A)

2. Water quality testing by MWP and DEC staff and volunteers measured water quality parameters and flow characteristics at fecal coliform sample sites and established a gauging station. (Attachment B)

3. Periodic stream sampling for baseline water quality (Temp, DO, Turbidity, ph, conductivity) at sample sites and locations of interest, provided comparative data for Fecal Coliform (FC) measures to assess the significance of flow on water quality variation through seasonal extremes.

4. MWP staff and volunteers collected 24 FC samples for analysis by the local certified water quality testing lab (Analytica Inc.) along with baseline measures. We modified the sampling strategy on June 6, 2005 to get two samples to better identify potential sources of FC contamination associated with the commercial development on Sherwood Lane.

Benefits from this work are:

1. Physical parameters for flow and temperature can be compared with annual rainfall records for the Mendenhall Valley and indexed with stream gauging stations in other Jordan creek provide comparative data to analyze soil saturation trends and runoff patterns with respect to precipitation. This can provide some insight into whether FC contamination is related to subsurface water saturation, surface sheeting or possibly some other factors.

2. A Field measurement on relative flow at each sample sites provides a better understanding of the relative water quality for major stream tributaries.

3. Design of the sample sites provides cumulative measures of water quality and FC contamination that better identify sources and relative significance of non-point contamination. This will allow DEC to better identify whether residential and commercial septic systems are functioning properly under high and low flow events and to initiate actions to improve failing systems.

4. Baseline and FC sample data collected in FY05 will allow MWP, UAS and DEC staff to further refine the sampling design in the FY06 study.

Baseline Data

MWP conducted two sample studies. The first was for baseline water quality during winter and early spring during cold weather conditions at low and moderate flow. The second was during late spring and early summer with associated FC samples to assess FC contamination. The FC sample was to include a range of high and low flow events. However, low rainfall and unusually warm conditions appeared to preclude any high flow events and all measures were and low flow. Some sample sites were lacking flow and indicate that some tributaries are ephemeral during low flow. Data collected in the winter did not include reliable DO measurements due to instrument malfunction or turbidity.

Data collected in the spring included DO (MWP purchased a new DO/TEMP meter to replace the malfunctioning YSI multi-meter provided by UAS) and turbidity along with FC samples analyzed by the local certified lab.

Watershed Assessment

Physical and Natural History of Pederson Hill Creek

The Mendenhall Glacier recession over the last hundred years is the principle natural force in Mendenhall Watershed streams. Isostatic rebound resulting from diminishing ice fields and a trend to warmer and dryer climatic conditions have reduced the and amount of runoff in all tributary streams in the watershed. Success ional vegetation stages have changed the biotic components of streams including vegetative buffers, organic loading and in-channel and riparian plant/animal communities.

Pederson Hill Creek is a marginal drainage system on the west side of the Mendenhall Valley that drains both Pederson Hill on the Mendenhall Peninsula and an unnamed ridge separating the Mendenhall and Auk drainages. A tributary named Casa Del Sol Creek drains the fields to the west of the Mendenhall River. Pederson Hill Creek carries through a mixed meadow and estuary collecting a number of small side valley tributaries until it meets with the Mendenhall River in the estuary near the south end of Mendenhall Peninsula.

Hill side tributaries start as relatively high gradient, bedrock contained primary channels that are influenced primarily by surface and subsurface flow. These source streams are ephemeral and respond to rainfall and snowmelt events. Along road systems drainage ditches contribute surface flow from sheeting flow which empty into tributary streams.

Soils are generally bedrock, fractured rock and cobble in primary streams, changing to gravels and mixed gravel/cobble in secondary stream reaches which tend to be associated with climax or secondary forest (mixed spruce/hemlock) habitats. These provide stream complexity (pool and riffle systems with Large Woody Debris (LWD) contributing structure) and contained by mixed clay/silt/soil banks with significant root systems. In the meadows and wetlands, soils are generally glacial silts, marine silts and clays, and mixed gravel. In forest/meadow margins aquatic-associated plants, especially skunk cabbage grows within the stream channel. Riparian zones contain mixed alder/willow and some meadow forbs.

Anadromous and saltwater-tolerant fish are present throughout much of the secondary streams. These include salmon, stickleback, Dolly Varden char and marine species in the lower reaches. Coho salmon run up to the road culverts on Glacier Highway and Engineers Cutoff. Coho fry and pre-smolt are abundant in the pools within the forested margins and present in small pools in the meadow reaches.

Development

Residential and commercial development, roads and other structures and uses have had significant impact on the stream system. Glacier Highway and Engineers cutoff include culverts that channel tributary streams; some are in marginal state of repair. Drainage ditches channel flow along roads into tributary stream. Debris (garbage, trash and road gravel) are introduced into the stream system at road crossings.

Residential and commercial buildings within the Pederson Hill drainage are outside of the Juneau sewage treatment system and rely on on-site septic and grey water systems. Four areas are defined based on drainage pattern and usage:

Area 1. North Glacier Highway drains through several residential subdivisions and includes some commercial uses including a church. Measured at Site 2.

Area 2. South Glacier Highway/Engineers Cutoff drains through residential structures and mixed industrial (heavy equipment maintenance and storage) and commercial uses including a medical clinic and office buildings. Measured at Site 3.

Area 3. Engineers Cutoff drains primarily residential properties, although some remnant commercial/industrial uses are still present on estuary/meadow habitats. Measured at Site 5.

Area 4. Flat meadows with residential and industrial uses including parking lots, the local Fire Training Center, a golf course and agriculture uses (grazing). Measured at Sites 4, 6,7.

Impacts from development include:

- ? Changing flow characteristics: culverts and road ditches create channelization and prevents surface flow from disbursing through permeable soils.
- ? Contamination from residual industrial fuels/lubricants or buried debris
- ? Failing or marginal septic/grey water treatments systems
- ? Debris and trash accumulation where roads cross stream systems.

Analysis

Fecal Coliform Contamination

Table 1. summarizes FC sample levels collected at established sample sites and selected sites above and below the culvert draining through the Sherwood Ave commercial site. Fecal coliform levels at sites 1 (above development) and site 5 (Engineers cutoff tributary) show minimal levels of background FC. Sites 2 and 3 show higher levels attributed to road, residential and commercial/industrial development. Highest levels are recorded at site 4 (downstream from Sherwood Lane commercial area).

On June 9, two additional samples show a small increase in FC taken directly above the DMV culvert (130) as compared to the cumulative FC levels of the two main tributaries (Sites 2 and 3) indicating additional contamination from non-point sources between the sample sites.

April through June 2005 Fecal Coliform readings.	FC Levels					
	Top of flow					
	Date	18-Apr	12-May	9-Jun	16-Jun	24-Jun
Above Development	Site 1	3	2		33	90
N side glacier highway	Site 2	3	2	2.5	28	36.7
S Side glacier highway	Site 3	20	82	97.5	92	56.7
Above DMV Culvert	**Site 6**			**130**		
Below DMV Culvert	**Site 7**			**7600**		
Meadow Site (Staff Gauge)	Site 4	340	300	8100	50	433
Engineers Cutoff		**10**	**2**			**36.7**
	Bottom of flow					
Stream flow at gauge site.		**15-20L/s**	**5-10 L/s**	**<5 lps**	**<5 lps**	**<5 lps**

Table 1. Fecal Coliform readings returned by Analytica Inc. SM922D Method.

Overall, this system appears to be functioning well. Stream structure is maintained by natural features (bedrock, forest and meadow channel) and where culverts and drainage ditches are presents their impact in minor. Culverts have not created unusual erosion or have altered the downstream stability due to the intact plant buffers, stable substrate and relatively low flows in most conditions. The physical structure aids in retaining water quality as measured by DO, Temperature, ph and turbidity.

Groundwater sources in the primary channels remain constant until flow encounters development in subdivisions and road construction. Stream reaches through residential development and adjacent to road and drainage ditches are warmer, more turbid, have higher conductivity and lower DO than source groundwater.

The natural process of the intact forest reaches provide shade, aeration and appear to metabolize FC contamination. As the stream enters the estuarine meadow, it appears to receive significant levels of FC contamination from the commercial development on Sherwood lane including the State DMW office building, and other commercial uses. Flow through the meadow/forest margin is contained in defined channels and has diverse plant and invertebrate communities. Water quality is well within State defined parameters except for FC levels even at marginal flows of <5 Liter/sec.

RECOMMENDATIONS

Further study should be directed at further identifying the source of FC contamination and the impacts of high and low flow regimes on the level of contamination. A secondary study of how well FC contamination is metabolized in the estuary below the commercial district will show how much contamination is present in recreational areas including the Mendenhall Refuge and Golf Course.

Preliminary data indicates a strong correlation with FC contamination and the commercial development at Sherwood Lane. Locating the source of contamination will help give property owners incentive to improve or repair FC contamination sources.

Continued monitoring for FC will provide both pre and post treatment data to assess the effectiveness of any remedial work done on failing septic systems or other non-point sources.

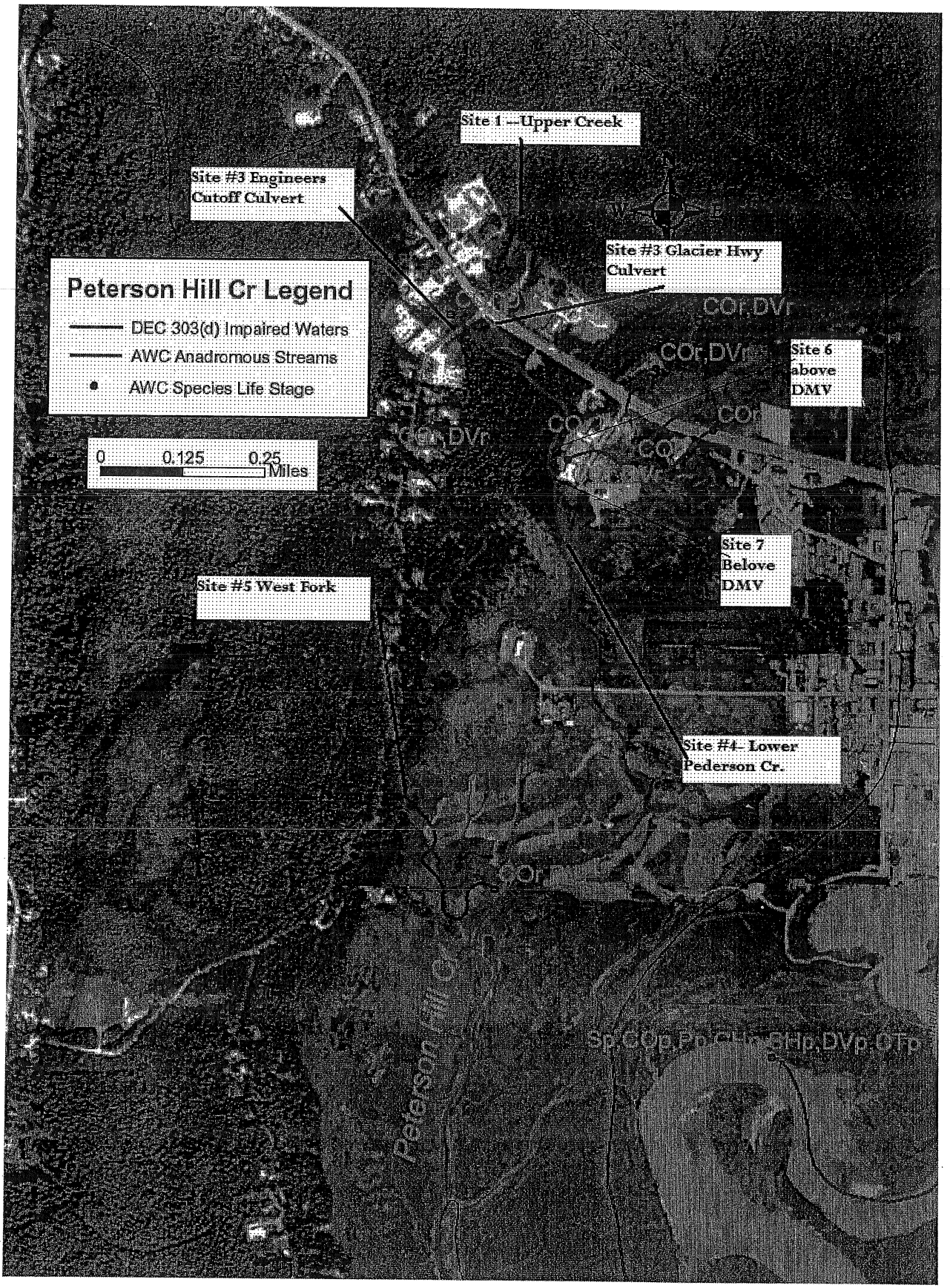
Photos:

Site 2, below Glacier Highway, High flow during winter rain event.

Site 3. Low flow on 5/12/05: unnamed tributary to Pederson Hill Creek

Site 4. Guaging Station at low flow (<5L/sec).

Site 4 low flow pool with coho fry (young of year).


Site 1 --Upper Creek
Site #3 Engineers Cutoff Culvert
Site #3 Glacier Hwy Culvert
Peterson Hill Cr Legend
DEC 303(d) Impaired Waters
AWC Anadromous Streams
AWC Species Life Stage
0 0.125 0.25 Miles
COr,DVr
Site 6 above DMV
Site 7 Belove DMV
Site #5 West Fork
Site #4- Lower Pederson Cr.
Peterson Creek

Pederson Hill Creek Reconnaissance, 12/3/2004
Lori Sowa (ADEC, Nonpoint Source), Mark Jaqua (MWP Executive Director), Carl Ferlauto (ADEC, Onsite WW Engineer)

Weather
Cool, Clear ~ 35 degrees F
PH Creek has decent flow, as the area has received much rainfall in the past weeks

Purpose of Trip
Mark and I went out to take a look at PH Creek to determine fecal coliform sampling locations for MWP's FY05 ACWA grant. Carl came along as much of the fecal coliform problem is suspected to come from failing on-site septic systems.

Observations
PH Creek is a small stream that is branched in many locations. The upper portion of the creek is crossed by Glacier Highway and Engineer's Cutoff Road a number of times. Residential subdivisions and various commercial properties (including a horse stabling operation) are located in this area. The many branches of the upper portion of the creek come together behind the DMV and flow over forested wetlands along the golf course. The west fork of PH Creek flows along Engineer's Cutoff Rd through dense residential housing, and then joins with the east fork and flows to saltwater. City sewer does not extend to any of the commercial or residential properties adjacent to PH Creek.

We walked much of the upper section of the east fork of PH Creek along Glacier Highway and then along Sherwood Lane, behind the DMV. An upstream, "baseline" sampling location was identified up behind the Baptist Church parking lot, upstream of the Hamilton Street subdivision (see photo#1). However, it does appear some dog-walking may occur in this general area.

The culvert below Glacier Highway as depicted in Photo#2 drains the Hamilton Street subdivision and the Baptist Church. Some drainage from Swampy Acres was also observed flowing towards the culvert, although the majority of this property may drain to the east. New construction across the street from the Baptist Church would also drain to this area of the creek. Continuing down Engineer's Cutoff Rd, we again accessed the stream where a culvert crossed under the road (see photo#3). A sewage odor was noted in this area by all three of us. Iron floc was also evident in this area of the stream.

We drove down Sherwood Lane and again accessed the creek behind the DMV. A bridge was located as an easily accessible sampling location (see photo#4). Beyond this point, the creek appeared to flow undisturbed by development (photo#5). We then walked along the fire training area to identify other braches of the creek, and none were found.

Next we took a quick look at the west fork of PH Creek, further down Engineer's Cutoff Road. We accessed the creek over a hillside across from the airport in the flats, approximately ¼ mile before the west fork joins with the east fork of PH Creek. The creek is very small in this area, and the smell of sewage was again apparent to all three of us.

Outcome
A number of sampling locations were identified along PH Creek for MWP's FY05 assessment project. Water quality sampling for basic field parameters, flow, and fecal coliforms will be performed along with qualitative habitat/bank stability observations as part of their project.

Pederson Hill Creek Water Quality Sampling

ACWA Grant 05-12

	Date	Site	DO	Temp	Turbidity	Conductivi	ph	FC (analytica)	Comments
Jaqua	18-Apr	1	12.5	4.6	n/a	n/a	n/a	<3.3	
High school	18-Apr	2	15.2	4.8	n/a	n/a	n/a	<3.3	
volunteers	18-Apr	3	14.5	5	n/a	n/a	n/a	20	
	18-Apr	4	14.5	4.6	n/a	n/a	n/a	340	Staff Guage 7.28 inches, about .3 m/sec
	18-Apr	5	14	4	n/a	n/a	n/a	10	At convergence of PHC and West channel
Jaqua,	12-May	1	14.7	10.36	5.35	0.026	6.8	2	Samply 1
High school	12-May	2	10.9	10.7	6.79	0.438	6.8	<2	Sample 2
volunteers	12-May	3	7.74	10.2	6.81	0.35	6.7	82	Sample 3
	12-May	4	13.38	13.1	4.8	0.17	7.4	300	Sample 4 Staff Guage dry minimal flow in str
	12-May	5	11.7	10.7	3.06	0.07	6.7	<2	Sample 5 At road culvert Engineers cutoff
Jaqua, Jaqua	9-Jun	1	14	10.3	4.02	0.0026	6.14	no sample	no surface flow, substrate pool
Sowa	9-Jun	2	7.9	14.2	7.04	0.438	7.04	2.5	Sample 1 low flow, sample from pooled water
	9-Jun	3	9.8	13	8.83	0.59	6.6	97.5	Sample 2 low flow, sample from pooled water
	9-Jun	4	9.45	13.7	8.17	0.193	7.32	8100	Sample 3 minimal flow in creek
	9-Jun	Below DMV						7600	Sample 4 Below DMV
	9-Jun	Above DMV						130	Sample 5 Above DMV
Jaqua, Jaqua	16-Jun	1	13.3	8.75	1.49	0.0026	6	33.3	Sample 1 no surface flow, substrate pool
	16-Jun	2	9	9	4.43	0.379	6.5	28	Sample 2 low flow,
	16-Jun	3	10.1	13.2	6.54	0.166	6.6	92	Sample 3 low flow,
	16-Jun	4	9.8	12	8.8	0.211	7.1	580	Sample 4 low flow, Photos

Samples following two days of rain, no measurable change in flow at all sites.

	Site	DO	Temp	Turbidity	Conductivi	ph	FC (analytica)	
Jaqua, Jaqua	24-Jun	1	11.52	10.5	1.35	0.014	6	90 Photos
	24-Jun	2	8.6	15.1	5.84	0.265	6.64	36.7
	24-Jun	3	10.2	13	15	0.017	6.84	56.7
	24-Jun	4	11.08	12.3	5.21	0.018	7.15	433
	24-Jun	5	10.68	11.78	0.86	0.052	6.67	36.7

FC sample Results

Date	18-Apr	12-May	9-Jun	16-Jun	24-Jun
Site 1	3	2		33	90
Site 2	3	2	2.5	28	36.7
Site 3	20	82	97.5	92	56.7
Site 4	340	300	8100	580	433
Site 5	10	2			36.7
Site 6			130		
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FC Levels April through June 2005						
	Top of Stream					
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	Bottom of Stream					
Stream flow at guage site		15-20 l/s	5-10 l/s	<5 lps	<5 lps	<5 lps

ACWA 05-12 Pederson Hill Field Sampling Data--Dave Hannah, Linzey Hanna

SITE 1

DATE	DO%	DO mg/L	Temperatu	Conductivi	pH
12/30/2000		21.53	-0.05	0.023	5.31
1/4/2001	151.4	23.13	0.05	0.24	6.81
1/22/2001	314.8	46.15	-0.05	0.022	6.21
1/29/2001	180.1	26.35	-0.08	0.023	4.18
1/0/1900	304.1	44.16	0.12	0.019	5.24

SITE 2

DATE	DO%	DO mg/L	Temperatu	Conductivi	pH
12/30/2000		17	-0.02	0.178	6.48
1/4/2001	151.1	22	0.01	1.212	6.45
1/22/2001	190.1	27.53	-0.06	0.281	6.28
1/29/2001	119.5	26.15	-0.07	0.188	6.04
1/0/1900	433.7	61.76	0	0.241	6.53

SITE 3

DATE	DO%	DO mg/L	Temperatu	Conductivi	pH
12/30/2000	144	21.17	0.02	0.127	6.35
1/4/2001	146.8	20.66	1.4	0.151	6.55
1/22/2001	183.4	26.45	0.485	0.117	6.41
1/29/2001	222.4	32.64	-0.07	101	5.82
1/0/1900	410.8	59.18	0.64	0.105	6.44

SITE 4

DATE	DO%	DO mg/L	Temperatu	Conductivi	pH
12/30/2000	111	16.5	-0.05	0.105	6.9
1/4/2001	153.3	22.41	-0.06	0.291	6.62
1/22/2001	179	26.2	-0.08	0.211	6.41
1/29/2001	185.2	27.14	-0.07	0.148	5.85
1/0/1900	229.2	33.52	-0.07	0.11	6.09