

Biological Assessment of
Feldspar Corporation
Putnam County
NPDES #FL0028525
Sampled 28 May and 24 June 1991

October 1991

Biology Section
Division of Technical Services

Department of Environmental Regulation

Results of Fifth Year Inspections

Discharger: Feldspar Corporation
County: Putnam
NPDES Number: FL0028525
State Permit Expiration Date: 25 November 1991

Toxics Sampling Inspection (**XSI**)	
Date Sampled:	28 May 1991
Results:	Aluminum (92 µg/L), iron (34 µg/L), and barium (5 µg/L). No organic priority pollutants above detection limit.

Compliance Biomonitoring Inspection (**CBI**)	
Date Sampled:	28 May 1991
Results:	Not toxic to *Ceriodaphnia dubia* or *Notropis leedsi.*

Impact Bioassessment Inspection (**IBI**)	
Date Sampled:	28 May and 24 June 1991
Results:	Benthic macroinvertebrate communities healthy and diverse, with a high number of pollution sensitive taxa. Periphyton community downstream of facility healthy, typical of an undisturbed system.

Water Quality Inspection (**WQI**)	
Date Sampled:	28 May and 24 June 1991
Results:	Nutrients either at low levels or undetected in the effluent and at reference and test sites. Correspondingly, algal growth potential and chlorophyll *a* not elevated.

These fifth year inspections provide the necessary information to evaluate the facility's impact on its receiving waters and to provide the basis for specific condition recommendations for permit renewal.

Introduction

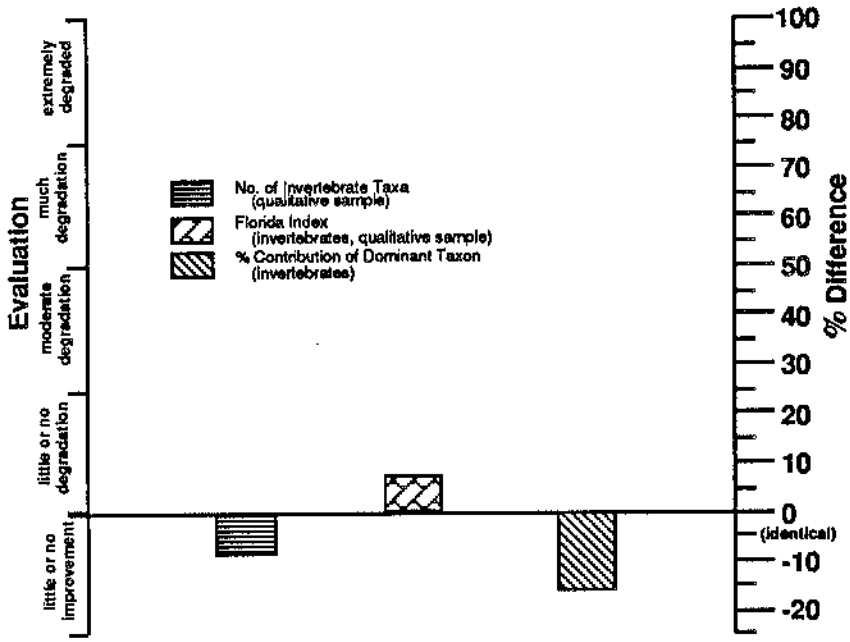
The Feldspar Corporation Industrial Wastewater Treatment Plant is located on Route C20A in Edgar, Putnam County, Florida. This plant discharges wastewater generated from the mining and processing of kaolin clay, glass sand, and other industrial sands for the ceramic, glass container, and construction industries. The clay is gravity settled in a series of vats, and the overflow moves through settling ponds and then through approximately 0.25 mile of ditching to an abandoned mine (Big North Pit). Big North Pit overflows to an unnamed swamp, and then forms the headwaters of Cabbage Creek, which flows to Little Orange and Orange Creeks, and finally to the Oklawaha River. Production capacity of the plant is 100 tons of kaolin/day, and approximately 2.5 MGD of wastewater is discharged. Because no chemical processes are involved, the parameters of most concern are turbidity, total suspended solids, and pH. The Feldspar Corporation has consistently met state and federal permit limitations.

Methods

The focus of this investigation was to determine the discharger's effects on the receiving waters. A comparison of biological community health was made between a reference site (located in Deep Creek, approxi-

Major characteristics of community structure of control and test sites.

	Reference Site	Test Site
Macroinvertebrate Qualitative		
Number of Taxa	36	39
Florida Index	26	24
% Contribution of Dominant Taxon	15.2	12.7
% Malacostraca	17.7	20.1
% Coleoptera	2.5	13.4
% Trichoptera	22.8	14.2
% Diptera	39.2	41.0
% Ephemeroptera	3.8	2.2
% Odonata	6.3	5.2
% Other	7.6	3.7
% Predators	17.7	29.5
% Collector-Gatherers	44.4	29.0
% Collector-Filterers	16.9	13.0
% Scrapers	11.0	16.4
% Shredders	10.0	12.3
Macroinvertebrate Hester-Dendy		
Number of Taxa		32
Florida Index		22
Shannon-Weaver Diversity		3.6
% Ephemeroptera		31.5
% Diptera		53.3
% Trichoptera		5.5
% Coleoptera		6.6
% Gastropoda		1.0
% Acarina		1.7
% Other		0.3
% Predators		17.0
% Collector-Gatherers		33.9
% Collector-Filterers		18.8
% Scrapers		21.2
% Shredders		9.0
% Parasites		0.1
Periphyton Algae		
Number of Taxa		30
% Contribution of Dominant Taxon		37.7
Chlorophyll a (mg/sq. m)		2.14
Diatom/B-G Abundance Ratio		.95
% Blue-green		4.6
% Green		0.3
% Diatoms		95.1
Algal Growth Potential (mg dry wt/l)	2.227	



Effect of discharge on receiving stream
(measured as difference between control and test sites).

mately 3.5 miles from the mining operation) and a test site in Cabbage Creek (the area 0.75 miles down gradient of the discharge) (see maps in Appendix). A habitat assessment was performed *in situ* to establish comparability between sites. Supplemental physical/chemical data were also collected on the effluent and study sites. Acute screening toxicity bioassays, using *Ceriodaphnia dubia* and *Notropis leedsi* as test organisms, were performed on an effluent sample (Peltier and Weber 1985, FDER 1985). The effluent was analyzed for organic constituents (base neutrals, acid extractables, and pesticide extractables) and metals. Additionally, nutrient analyses were performed on reference and test sites. The habitat assessment and sampling for nutrients at the reference site were conducted on 24 June; all other chemical and biological sampling at the test and effluent sites was conducted on 28 May, 1991. Methods used for all chemical analyses are on file at the Tallahassee DER Chemistry Laboratory.

Benthic macroinvertebrate communities were evaluated at reference and test sites. Collection methods consisted of a timed (one hour per site) multi-substrate (*e.g.*, snags, vegetation, sediment) semi-quantitative effort. An additional invertebrate collection was accomplished at the test site using Hester-Dendy multiplate samplers which were incubated for 28 days (Ross 1990). Periphyton was sampled at the test site by incubating glass microscope slides in a standard periphytometer for 28 days (Ross 1990). Chlorophyll *a* was also determined for this periphyton community (Ross 1990). Bacterial populations were analyzed at effluent and the downstream sites for total and fecal coliforms following the methods of APHA (1989). An Algal Growth Potential test performed on a sample from the reference site, using *Selenastrum capricornutum* as the test organism, followed Miller *et al.* (1978).

Explanation of Measurements of Community Health

Several different measurements of macroinvertebrate and algal community health have been employed. Many of these, such as the number of taxa, Shannon-Weaver Diversity Index, and chlorophyll *a* are well known. Others are briefly explained here. The Florida Index assigns points to stream-dwelling macroinvertebrates based on their sensitivity to pollution (see Ross 1990). A site with a high Florida Index score is considered healthy (*i.e.*, many clean-water organisms are present). Excessive numerical dominance of a single type of organism (a high % contribution of dominant taxon) is usually associated with disturbance. A decreased diatom to blue-green algae ratio (calculated by dividing the number of individuals in the Bacillariophyta by the number of individuals in the Bacillariophyta + Cyanophyta) is often indicative of nutrient enriched conditions. The determination of the Quantitative Stability Index (for taxonomic % composition) is a two step process. First, the relative proportions of major taxonomic groups are calculated for each site. Then, the lesser of the two percentages for each discrete taxonomic group is totaled. A QSI (% composition) of 100% means that the two sites being compared are identical. This same type of procedure is used for calculating the QSI (functional feeding groups).

For graphical purposes, the percent differences between the refer-

ence and test sites involving the number of taxa and the Florida Index are measured as the reference site minus test site divided by the reference site. The percent difference between sites involving the percent contribution of dominant taxon is measured as the test site minus reference site divided by the reference site.

The following personnel were involved in this investigation: Scott Bulgrin (DER Northeast District) and Lyn Burton, Russel Frydenborg, Kathleen Lurding, and Sandy McClure (Tallahassee Biology Laboratory).

Results and Discussion

Habitat quality was better at the test site than at the reference site, with habitat scores of 90 and 73, respectively (Appendix). Most of the difference was due to the excellent bottom substrate characteristics at the Cabbage Creek site. The physical/chemical attributes of the two areas were quite similar, although the test site was slightly more acidic and had a lower specific conductance. Both sites were well oxygenated, with D.O.'s above 7.2 mg/L (Appendix).

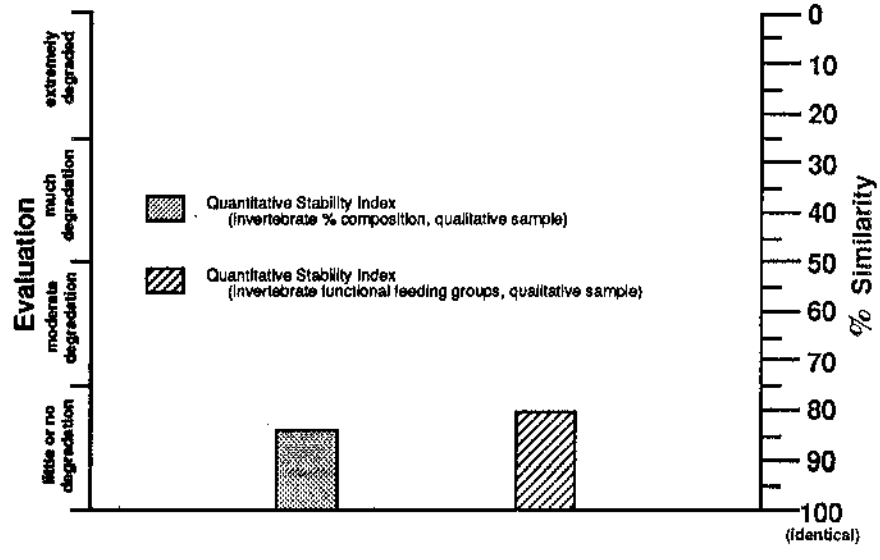
The effluent sample collected from the Big North Pit overflow was not toxic to the cladoceran, *Ceriodaphnia dubia*, or to the fish, *Notropis leedsi*. No mortality occurred during the 48 hour static acute bioassay (Appendix). No organic priority pollutants were found above detection limits in this grab sample. The metals aluminum (92 µg/L), iron (34 µg/L), and barium (5 µg/L) were detected in the effluent sample. These concentrations are well below ambient standards and are no cause for concern. The same metals were also found at the downstream site but at even lower levels (Appendix).

Nutrients were low throughout the system. Total phosphorus and NO_2NO_3 were undetected in the effluent, and at the reference and test sites (note that TP detection limits were 0.05 mg/L). Orthophosphorus was undetected at effluent and test sites, but was found at a concentration of 0.046 mg/L at the reference site in Deep Creek. Ammonia and TKN were measured at discharge and study sites, but not at levels which would indicate enrichment (Appendix). The algal growth potential measured at the reference site was 2.227 mg dry wt/L as would be expected from the low nutrient concentrations.

Bacterial populations were analyzed at the discharge and downstream sites. Fecal coliforms were present at less than 100 organisms/100 mL in the effluent. Densities of total and fecal coliforms at the test site were 580 and 120 organisms/100 mL, respectively (Appendix). These bacterial levels are fairly typical of flowing waters.

Qualitative measures of benthic macroinvertebrate community health indicated that both the reference and test sites supported a diverse population of many pollution-sensitive organisms (see table and figures). The figure on p. 2 indicates the degree of difference between the reference and test sites. Larger differences (that is, higher percentages) correspond with greater degrees of degradation. Negative values mean that the test site is better than the reference. The figure on this page summarizes similarities between the sites. Smaller similarities (lower percentages) generally correspond with greater degradation.

Species richness was quite good at both sites, with 36 and 39 taxa recovered from reference and test sites, respectively. Florida Index scores were 26 at the reference and 24 at the test site, indicating healthy conditions. The Quantitative Stability Indices for percent composition



Effect of discharge on receiving stream
(measured as similarity between control and test sites).

and functional feeding groups further emphasize the similarity between these two study sites.

Periphyton data were not collected at the reference site, and therefore, no longitudinal comparison can be made. However, the attached algal community at the test site was typical of a pristine stream system. Thirty taxa were identified (see taxa list in Appendix), and diatoms made up 95% of the algal population. The most dominant taxon, *Cocconeis placentula*, is very common in Florida streams and is considered to be cosmopolitan. Chlorophyll *a* was low (2.14 mg/m^2), corresponding to the low nutrient levels mentioned previously.

Conclusions

The discharge sample collected from the Feldspar Corporation was not toxic to the bioassay test organisms. No organic priority pollutants were detected in the effluent, and a few metals were present at relatively low concentrations. Nutrients were low at all study sites, supported by algal growth potential and chlorophyll a results, which also indicated non-enrichment. Bacterial populations measured in the effluent and downstream site were typical of background levels. Both benthic macroinvertebrate and periphyton communities were healthy and diverse. This facility appeared to have no negative environmental effects on the receiving waters.

Literature Cited

American Public Health Assoc., American Water Works Assoc., and Water Pollution Control Federation. 1989. Standard Methods for the Examination of Water and Wastewater, 17th ed. New York, N.Y. 1268 pp.

Florida Department of Environmental Regulation. 1985. Quality assurance manual for performing acute toxicity tests. 2nd edition. Fla. Dept. Environmental Regulation, Biology Section, Tallahassee. 53 pp.

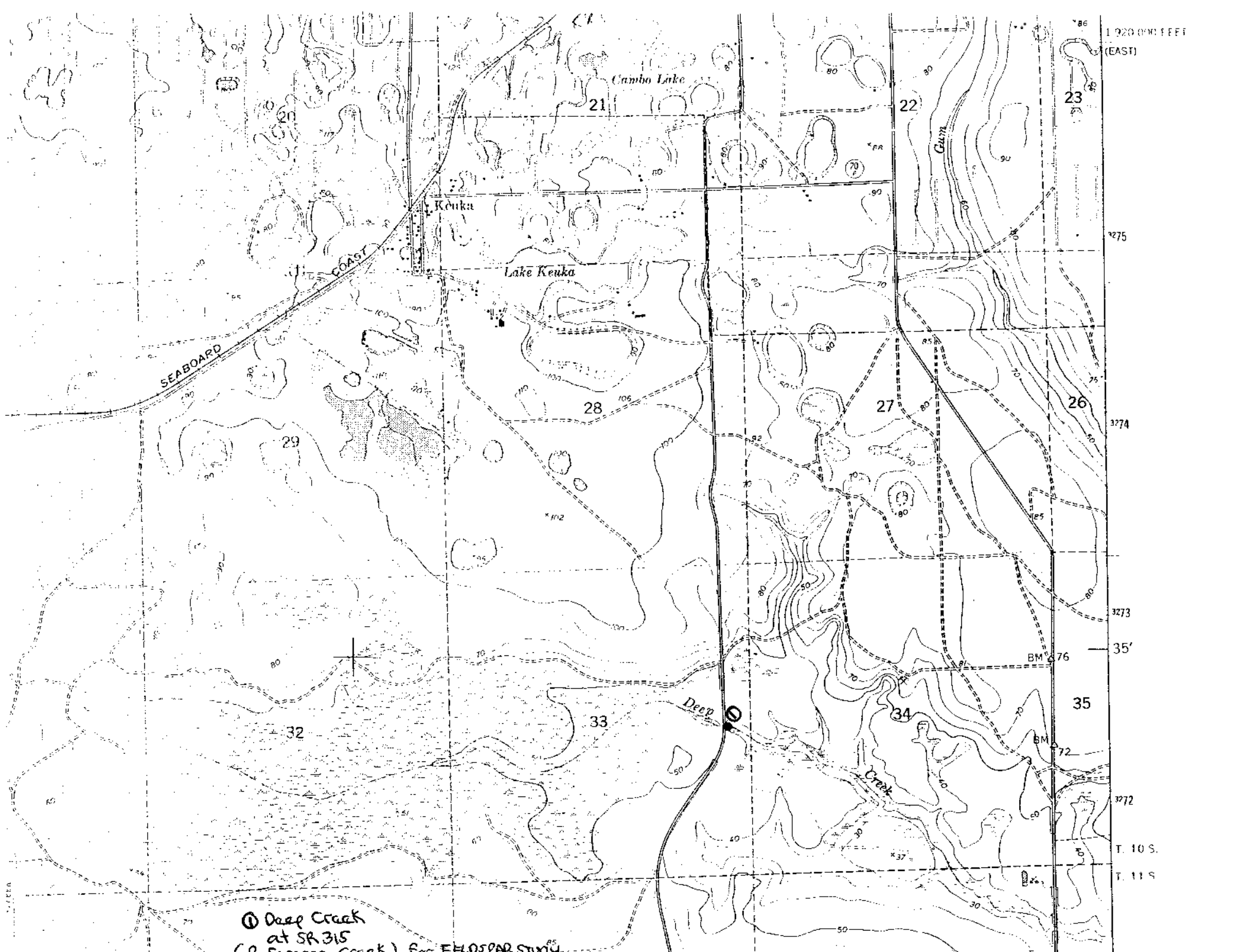
Miller, W. E., T. E. Maloney, and J. C. Greene. 1978. The *Selenastrum capricornutum* Printz algal assay bottle test. U. S. Environ. Prot. Agency, EPA-600/9-78-018. 126 pp.

Peltier, W. H. and C. I. Weber. 1985. Methods for measuring the acute toxicity of effluents to freshwater and marine organisms. 3rd edition. EPA/600/4-85/013. U. S. EPA, Cincinnati, Ohio. 216 pp.

Ross, L. T. 1990. Methods for aquatic biology. Fla. Dept. Environ. Reg. Tech. Ser. 10(1): 1-47.



② Cabbage Creek FELDSPAR
Downstream 3/4 mile from Effluent 003


Cambo Lake
Keuka
Lake Keuka
SEABOARD COAST
Deep
Creek
Gum
BM 76
BM 72
1,920,000 FEET
(EAST)
3275
3274
3273
3272
35'
T. 10 S.
T. 11 S.
20
21
22
23
26
27
28
29
32
33
34
35
① Deep Creek at SR 315 (a Suwannee Creek) See FEldspar Study

Chemistry summary table for Feldspar Corporation	Effluent	Deep Creek (Control Site)	Cabbage Ck (Test Site)
Metals (ug/L)			
Aluminum	92		39 T
Arsenic	20 U		20 U
Barium	5		5
Cadmium	0.1 K		0.1 U
Copper	5 U		5 U
Chromium	10 U		10 U
Iron	34		27
Lead	15 U		15 U
Mercury	0.2 U		0.2 K
Nickel	5 U		5 U
Selenium	5 K		5 U
Silver	0.2 U		0.2 U
Zinc	5 U		5 U
Nutrients (mg/L)			
Ortho-phosphorus	0.02 U	0.046 A	0.02 U
Total phosphorus	0.05 U	0.05 U	0.05 U
Ammonia	0.048 A	0.028 T	0.047 A
Nitrate+Nitrite	0.04 U	0.04 U	0.04 U
TKN	0.23	0.3	0.41
Other Parameters			
Habitat Assessment		73	90
D.O.	8.80	7.25	7.30
pH	6.6	7.0	6.3
Conductivity/Salinity	165	140	118
Temperature	28.0	26.1	26.2
Bioassay: Fish	Not Toxic		
Bioassay: Invertebrate	Not Toxic		
Fecal coliform (org/100 mL)	<100		120
Total coliform (org/100 mL)			580

A - Value reported is the mean of two or more determinations

K - Actual value is known to be less than value given

T - Value reported is less than the practical quantitation limit

U - Material was analyzed for but not detected; value reported is the min. detection limit

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: 8031 / SUBMITTING AGENCY NAME: Fla. D.E.R. NorthEast District	STORET STATION NUMBER:	DATE (M/D/Y): 06/24/91	RECEIVING BODY OF WATER: Deep Creek to the Rodman Reservoir

REMARKS: Hot, Sunny 90°F	LOCATION: Deep Creek at SR 315	FIELD ID/NAME: Reference Creek for Feldspar Study

Habitat Parameter / score	Excellent	Good	Fair	Poor
Bottom Substrate/ Available Cover 18	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs, undercut banks, rubble, or other stable habitat. **23-30 points**	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. **16-22 points**	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat. **8-15 points**	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious. **0-7 points**
Water Velocity 22	Max. observed; >0.3 m/sec. **23-30 points**	Max. observed; 0.1 to 0.3 m/sec **16-22 points**	Max. observed; 0.05 to 0.1 m/sec **8-15 points**	Max. observed; <0.05 m/sec **0-7 points**
Artificial Channel/ Flow Alteration 15	No artificial channelization. Little activity (impervious surface) in watershed which would cause scouring during spates. **12-15 points**	—	—	Artificially channelized, or scouring present during spates because of excess impervious surface in watershed. **0-3 points**
Bank Stability 10	Stable. No evidence of erosion or bank failure. Little potential for future problems. **9-10 points**	Moderately stable. Infrequent or small areas of erosion, mostly healed over. **6-8 points**	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. **3-5 points**	Unstable. Many raw, eroded areas. Obvious bank sloughing. **0-2 points**
Riparian Zone Vegetation Quality 8	Over 80% of streambank surfaces consist of native plants, classified as: bottomland hardwoods, understory shrubs, or non-woody macrophytes. **9-10 points**	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. **6-8 points**	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. **3-5 points**	Less than 25% of streambank surfaces are vegetated. Poor plant community (e.g. grass monoculture) present. **0-2 points**

Adjustments _____ Add 5 points if cross-sectional area of flow is estimated to be greater than one square meter during periods of normal flow.

TOTAL SCORE 73

COMMENTS: Pristine Area around Deep Creek with some small residential areas nearby. Popular fishing hole for locals

ANALYSIS DATE: 06/24/91 | ANALYST: SCOTT BULGRIN | SIGNATURE: Scott Bulgrin

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: 8031 / SUBMITTING AGENCY NAME: Fla. D.E.R. Northeast District	STORET STATION NUMBER:	DATE (M/D/Y): 05/28/91	RECEIVING BODY OF WATER: Cabbage Creek to Little Orange Creek to Orange Creek to Oklawaha River

REMARKS: Pristine Area No manmade Impacts observed	LOCATION: Cabbage Creek Downstream 3/4 mile from Effluent 003	FIELD ID/NAME: Downstream Study Site

Habitat Parameter / score	Excellent	Good	Fair	Poor
Bottom Substrate/ Available Cover 28	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs, undercut banks, rubble, or other stable habitat. **23-30 points**	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. **16-22 points**	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat. **8-15 points**	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious. **0-7 points**
Water Velocity 23	Max. observed; >0.3 m/sec. **23-30 points**	Max. observed; 0.1 to 0.3 m/sec **16-22 points**	Max. observed; 0.05 to 0.1 m/sec **8-15 points**	Max. observed; <0.05 m/sec **0-7 points**
Artificial Channel/ Flow Alteration 15	No artificial channelization. Little activity (impervious surface) in watershed which would cause scouring during spates. **12-15 points**	—	—	Artificially channelized, or scouring present during spates because of excess impervious surface in watershed. **0-3 points**
Bank Stability 10	Stable. No evidence of erosion or bank failure. Little potential for future problems. **9-10 points**	Moderately stable. Infrequent or small areas of erosion, mostly healed over. **6-8 points**	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. **3-5 points**	Unstable. Many raw, eroded areas. Obvious bank sloughing. **0-2 points**
Riparian Zone Vegetation Quality 9	Over 80% of streambank surfaces consist of native plants, classified as: bottomland hardwoods, understory shrubs, or non-woody macrophytes. **9-10 points**	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. **6-8 points**	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. **3-5 points**	Less than 25% of streambank surfaces are vegetated. Poor plant community (e.g. grass monoculture) present. **0-2 points**

Adjustments: 5	Add **5 points** if cross-sectional area of flow is estimated to be greater than one square meter during periods of normal flow.	TOTAL SCORE: 90

COMMENTS: HOT, Sunny 85°F, stream has good flow and is very pristine. Fish and Macrophytes around.

ANALYSIS DATE: 05/28/91	ANALYST: SCOTT BULGRIN	SIGNATURE: Scott Bulgrin

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

PHYSICAL CHEMICAL CHARACTERIZATION FIELD DATA SHEET

SUBMITTING AGENCY CODE: 8031 / SUBMITTING AGENCY NAME: Fla. D.E.R. Northeast District	STORET STATION NUMBER	DATE (M/D/Y): 06/24/91	RECEIVING BODY OF WATER: Deep Creek to the Rodman Reservoir.

REMARKS: Hot Sunny 90°F Area Semi-Pristine Human Activity (Recreational)	LOCATION: Deep Creek at SR 315	FIELD NAME: Reference Creek for Feldspar Study

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Surrounding Land-Use (specify relative percent in each category):

Forest	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other
90	8		2			

Local Watershed Erosion (check box): None [X] Moderate [ ] Heavy [ ]

Local Watershed NPS Pollution (check box): No evidence [X] Some potential sources [ ] Obvious sources [ ]

Point-Source Pollution (list location and describe): Some urban (road) run-off, Human Activity

Estimated Stream Width (range, m): 3.0	Estimated Stream Depth (range, m): 1.0	Impounded [ ] yes [ ] natural
High Water Mark (m above bed): 1.0	Velocity (range, m/s): 0.3	Channelized [X] yes [ ] natural

Canopy Cover % (check box): Open: [ ] Lightly Shaded: [ ] Moderately Shaded: [X] 75% Heavily Shaded: [ ]

SEDIMENT/SUBSTRATE

Sediment Odors: Normal: [X] Sewage: [ ] Petroleum: [ ] Chemical: [ ] Anaerobic: [ ] Other: [ ] _____

Sediment Oils: Absent: [X] Slight: [ ] Moderate: [ ] Profuse: [ ]

Sediment Deposits: Sludge: [ ] Paper Fiber: [ ] Mud: [X] Sand: [X] Shell: [ ] Other: [X] Detritus

Substrate Types (estimated % surface coverage):

Limestone:		Sand/Silt/Clay Mix:	5
Consolidated Clay:		Clay/Silt (inorganic):	
Gravel/Shell		Coarse Organic Debris:	25
Sand:	40	Mud/Muck (organic):	30

WATER QUALITY

	Temp. (°C):	D.O. (mg/l):		
Top	26.1	7.25	Secchi Depth (m):	0.72
Mid-depth	26.1	7.25	pH (SU):	6.99
Bottom	26.1	7.10	Conductivity (umho/cm):	140
			Other Parameters:	

Stream Type (check box): Blackwater: [ ] Deep Aquifer Fed: [ ] Surficial Aquifer Fed: [X] Alluvial: [ ] Other: [ ] _____

Water Odors (check box): Normal: [X] Sewage: [ ] Petroleum: [ ] Chemical: [ ] Other: [ ] _____

Water Surface Oils (check box): Slick: [ ] Sheen: [ ] Globs: [ ] None: [X]

Clarity (check box): Clear: [X] Slightly turbid: [ ] Turbid: [ ] Opaque: [ ]

Color (check box): Tannic: [ ] Green (algae): [ ] Clear: [X] Other: [ ] _____

Weather Conditions: Hot Sunny

Abundance:	Absent	Rare	Common	Abundant
Periphyton	[ ]	[ ]	[X]	[ ]
Fish	[ ]	[ ]	[X]	[ ]
Aquatic Macrophytes	[ ]	[X] 1-2 species	[ ]	[ ]
Iron/sulfur Bacteria	[X]	[ ]	[ ]	[ ]

ANALYSIS DATE:	ANALYST:	SIGNATURE:
06/24/91	SCOTT BULGRIN	Scott Bulgrin

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET

SUBMITTING AGENCY CODE: 8031 / SUBMITTING AGENCY NAME: Fla. D.E.R.	STORET STATION NUMBER:	DATE (M/D/Y): 05/28/91	RECEIVING BODY OF WATER: Cabbage Creek to Little Orange Creek to Orange Creek to Oklawaha River

REMARKS: Pristine Area Maples, oaks, Palmetto Forest area surround creek	LOCATION: Cabbage Creek Downstream 3/4 mile from Effluent003	FIELD ID/NAME: Downstream Feldspar Study Site.

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Surrounding Land-Use (specify relative percent in each category):

Forest	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other
100						

Local Watershed Erosion (check box): None ☐ Moderate ☐ Heavy ☐

Local Watershed NPS Pollution (check box): No evidence ☒ Some potential sources ☐ Obvious sources ☐

Point-Source Pollution (list location and describe): FELDSPAR Corporation Upstream

Estimated Stream Width (range, m): 1.5 m	Estimated Stream Depth (range, m): 0.6 m	Impounded: yes ☒ (Natural)
High Water Mark (m above bed): 0.5 m	Velocity (range, m/s): 0.3	Channelized: ☒ (Natural)

Canopy Cover % (check box): Open: ☐ Lightly Shaded: ☐ Moderately Shaded: ☐ Heavily Shaded: ☒ 85%

SEDIMENT/SUBSTRATE

Sediment Odors: Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐ _____

Sediment Oils: Absent: ☒ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposits: Sludge: ☐ Paper Fiber: ☐ Mud: ☒ Sand: ☒ Shell: ☐ Other: ☒ Detritus

Substrate Types (estimated % surface coverage):

Limestone:		Sand/Silt/Clay Mix:	10
Consolidated Clay:		Clay/Silt (inorganic):	
Gravel/Shell		Coarse Organic Debris:	10 DETRITUS
Sand:	50	Mud/Muck (organic):	30

WATER QUALITY

	Temp. (°C):	D.O. (mg/l):		
Top	26.2	7.3	Secchi Depth (m):	0.6 L
Mid-depth	26.2	7.3	pH (SU):	6.3
Bottom	26.2	7.2	Conductivity (µmho/cm):	118
			Other Parameters:	

Stream Type (check box): Blackwater: ☐ Deep Aquifer Fed: ☐ Surficial Aquifer Fed: ☒ Alluvial: ☐ Other: ☐ _____

Water Odors (check box): Normal: ☐ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐ _____

Water Surface Oils (check box): Slick: ☐ Sheen: ☐ Globs: ☐ None: ☒

Clarity (check box): Clear: ☒ Slightly turbid: ☐ Turbid: ☐ Opaque: ☐

Color (check box): Tannic: ☐ Green (algae): ☐ Clear: ☒ Other: ☐ _____

Weather Conditions: HOT Sunny, 89°

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☒	☐
Fish	☐	☐	☒	☐
Aquatic Macrophytes	☐	☒ 1-2 species	☒	☐
Iron/sulfur Bacteria	☒	☐	☐	☐

ANALYSIS DATE: 05/28/91	ANALYST: SCOTT BULGRIN	SIGNATURE: Scott L Bulgrin

Sample Source: Feldspar ~~North~~ NF

Address/City:

County: Putnam

Contact/District: Scott Bulgrin NorthEast

NPDES Permit #: FL0028515 Outfall #:

Sample Collection: Date 5/28/91 Time 1600

Test Beginning: Date 5/29/91 Time 1430

Test Ending: Date 5/31/91 Time 1000

Test Organism: Ceriodaphnia dubia

Life Stage/Age: < 24 hours

Test Number: 1 of 2 Test Type: Screening | Definitive
Static | Static Renewal | Flow-through

Remarks: North settling Pd. 8

Instrument Calibrations:

	pH	DO	Cond	Temp
0 hr	7.9 9	8.8 @ 22°C	139 @ 241 @ 1383	21 @ 24.0°C
24 hr	7.9 9	8.8 @ 22°C	1384 @ 238 @ 1376	21 @ 23.4
48 hr	7.9 9	8.8 @ 22°C	1388 @ 240 @ 1381	21 @ 22.6°C

Conc.	Chamber #	Number Live 0	24	48	DO (mg/l) 0	24	48	pH 0	24	48	Temp. (°C) 0	24	48	Cond. (µmhos/cm) 0	24	48
Control		5	5	5	8.8	8.8	8.6	8.0	8.3	~~8.5~~ 8.2	20.8	21.4	21.5	152	155	182
Control		5	5	5												
Control		5	5	5												
Control		5	5	5												
100%		5	5	5	9.7	8.9	8.7	7.5	7.8	~~7.9~~ 7.8	20.8	21.3	21.5	152	153	158
100%		5	5	5												
100%		5	5	5												
100%		5	5	5												
Measured/Loaded by:		MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF
Recorded by:		MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF

Investigators' Signatures

Marshall Faircloth

Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:			0.0	Hach	MF
Lab Tot. Resid. Cl2:			0.0	Hach	MF
Alkalinity:	115	60	7	Hach	MF
Hardness:	130	73	60	Hach	MF
Total Ammonia:					

Ammonia meter slope:

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: Feldspar
Address/City:
County:
Contact/District:
NPDES Permit #: **Outfall #:**

Sample Collection: Date 5/28/91 Time 1600
Test Beginning: Date 5/29/91 Time 1430
Test Ending: Date 5/31/91 Time 1000
Test Organism: Mysidopsis bahia
Life Stage/Age: 2 Sdays

Test Number: 2 of 2 **Test Type:** Screening | Definitive
Static | Static Renewal | Flow-through

Remarks:

Instrument Calibrations:

	pH	DO	Cond	Temp
0 hr	7.0 7.9	8.8 @ 21°C	1396 @ 24.1° 1383	21.7° @ 24.0°C
24 hr	7.0 7.9	8.8 @ 21°C	1384 @ 25.8° 1376	@ 21.0° @ 23.4°
48 hr				

		Number Live			DO (mg/l)			pH			Temp. (°C)			Cond. (µmhos/cm)		
Conc.	Chamber #	0	24	48	0	24	48	0	24	48	0	24	48	0	24	48
Control	47	5	5	5	8.0	7.8	7.8	7.8	8.1	8.2	20.9	20.8	21.0	242	244	248
Control	16	5	5	5	8.7	7.8	7.8	7.8	8.1	8.2						
100%	62	5	5	5	10.4	8.2	8.0	7.4	7.3	7.3	22.0	20.8	21.0	154	155	159
100%	184	5	5	5	10.4	8.4	8.1	7.4	7.3	7.3						
Measured/Loaded by:		MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF
Recorded by:		MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF

Investigators' Signatures

Marshall Fairbanks

Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:					
Lab Tot. Resid. Cl2:					
Alkalinity:					
Hardness:					
Total Ammonia:					

Ammonia meter slope:

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENT REGULATION
NORTHEAST DISTRICT
7825 BAYMEADOWS WAY SUITE 200B
JACKSONVILLE, FL 32256-7577

SAMPLE ID NO.: 91367 DATE: 1991/05/28
SAMPLE SOURCE: FELDSPAR INC. TIME: 1400
STATION NUMBER: SAMPLER: BULGRIN/FELTON
STATION LOCATION: CABBAGE CK. 3/4 MILE D.S. FROM FELDSPAR EFF 003
Fixed monitoring: Special Project: Dredge & Fill:
Intensive Survey: Response Operation:
Other: MODULE 1141
PARAMETERS PERFORMED
Natural Substrate: Qualitative: Sediment(grain size):
Bacteria: X Other:

FIELD MEASURMENTS
ph: 6.30 Conductivity: 118 Dissolved oxygen: 7.3 Temperature(C): 26.2
Secchi: >0.6 Total depth(ft.): 2.0

WEATHER CONDITIONS: HOT AND SUNNY

The following were analyzed by: Date out:
Sample depth (ft.) :
Species Diversity Index:
Quantitative # of taxa :
Density (#/m2) :
Qualitative # of taxa :
Florida Biotic Index :

The following were analyzed by: MIKE HOLLINGSWORTH Date out: 1991/06/04
All vaules reported in #/100mL

Total coliform (MF)	: 580M	Total coliform (MPN):	
Fecal coliform (MF)	: 120e	Fecal coliform (MPN):	
Fecal strep (MF)	:	Fecal strep (MPN):	
Heterotrophic Plate #/mL	:	Enterococci (MF) :	

MF : Membrane Filter
MPN: Most Probable Number (Tubes)
M : Moderate non-coliform growth
T: Too Numerous To Count n-c growth
C: Confluent (Heavy) n-c growth
e: Estimate count outside acpt. range

The following were analyzed by: Date out:
Sediment particle size % weight
Sample depth (ft.):
>2.0mm :
1.0 - 2.0mm :
0.5 - 2.0mm :
0.25 - 0.5mm :
0.125 - 0.5mm :
0.125 - 0.25mm :
0.0625 - 0.125mm :
<0.0625mm :
Sediment organic :

COMMENTS:

Approved By : LEE BANKS Date: 1991/06/07

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENT REGULATION
NORTHEAST DISTRICT
7825 BAYMEADOWS WAY SUITE 200B
JACKSONVILLE, FL 32256-7577

SAMPLE ID NO.: 91371 DATE: 1991/05/28
SAMPLE SOURCE: FELDSPAR INC. TIME: 1600
STATION NUMBER: SAMPLER: BULGRIN/FELTON
STATION LOCATION: FELDSPAR EFF @ NORTH SETTLING POND
Fixed monitoring: Special Project: Dredge & Fill:
Intensive Survey: Response Operation:
Other: MODULE 1141
PARAMETERS PERFORMED
Natural Substrate: Qualitative: Sediment(grain size):
Bacteria: X Other:

FIELD MEASURMENTS
ph: 6.57 Conductivity: 165 Dissolved oxygen: 8.8 Temperature(C): 28.0
Secchi: 0.3 Total depth(ft.): 1.0

WEATHER CONDITIONS: HOT AND SUNNY

The following were analyzed by: Date out:
Sample depth (ft.) :
Species Diversity Index:
Quantitative # of taxa :
Density (#/m2) :
Qualitative # of taxa :
Florida Biotic Index :

The following were analyzed by: MIKE HOLLINGSWORTH Date out: 1991/06/04
All vaules reported in #/100mL

Total coliform (MF)	:	Total coliform (MPN):	
Fecal coliform (MF)	: <100	Fecal coliform (MPN):	
Fecal strep (MF)	:	Fecal strep (MPN):	
Heterotrophic Plate #/mL	:	Enterococci (MF) :	

MF : Membrane Filter
MPN: Most Probable Number (Tubes)
M : Moderate non-coliform growth
T: Too Numerous To Count n-c growth
C: Confluent (Heavy) n-c growth
e: Estimate count outside acpt. range

The following were analyzed by: Date out:
Sediment particle size % weight
Sample depth (ft.):
>2.0mm :
1.0 - 2.0mm :
0.5 - 2.0mm :
0.25 - 0.5mm :
0.125 - 0.5mm :
0.125 - 0.25mm :
0.0625 - 0.125mm :
<0.0625mm :
Sediment organic :

COMMENTS:

Approved By : LEE BANKS Date: 1991/06/07

Taxa list for Feldspar Corporation, collected via Hester-Dendy samplers on 24 June, 1991, in Putnam Co., Florida.

	Test Site
Acarina	
Atractides sp.	1
Hygrobates sp.	2
Sperchonopsis sp.	2
Coleoptera	
Dineutus sp.	2
Macronychus glabratus	6
Microcylloepus pusillus	7
Stenelmis sp.	4
Diptera	
Corynoneura taris	1
Cryptochironomus sp.	1
Djalmabatista pulcher	1
Hemerodromia sp.	6
Meropelopia sp.	2
Nilotanypus fimbriatus	2
Parachironomus hirtalatus	1
Pentaneura inconspicua	11
Polypedilum convictum grp.	17
Polypedilum fallax grp.	4
Undetermined Dipteran pupa	12
Rheocricotopus robacki	51
Rheotanytarsus distinctissimus grp.	26
Rheotanytarsus exiguus grp.	10
Stelechomyia perpulchra	1
Tanytarsus sp.	5
Thienemaniella fusca	3
Ephemeroptera	
Acerpenna pygmaeus	4
Stenonema exiguum	87
Gastropoda	
Undetermined Ancylidae sp.	3
Odonata	
Hetaerina sp.	1
Trichoptera	
Cheumatopsyche sp.	1
Chimarra sp.	13
Nectopsyche sp.	1
Polycentropus sp.	1

Taxa list for Feldspar Corporation, collected via timed qualitative methods (dip net) on 24 June, 1991, in Putnam Co., Florida.

	Reference Site	Test Site
Coleoptera		
Dineutus discolor	–	2
Dineutus sp.	–	1
Dubiraphia sp.	1	–
Macronychus glabratus	1	–
Stenelmis sp.	–	15
Diptera		
Ablabesmyia janta	1	–
Ablabesmyia mallochi	2	–
Beardius sp.	1	–
Cricotopus bicinctus	–	2
Cricotopus/Orthocladius grp. sp.	5	1
Cryptotendipes sp.	–	1
Dicrotendipes neomodestus	1	–
Djalmabatista pulcher	–	1
Hemerodromia sp.	1	–
Pagastiella orophila	–	2
Palpomyia grp. sp.	2	2
Pentaneura inconspicua	1	2
Phaenopsectra sp.	1	–
Polypedilum convictum grp.	–	11
Polypedilum halterale grp.	–	3
Polypedilum illinoense	2	1
Paratanytarsus sp.	4	–
Undetermined Dipteran pupa	2	1
Rheocricotopus robacki	–	1
Rheotanytarsus distinctissimus grp.	–	7
Rheotanytarsus exiguus grp.	–	2
Stenochironomus sp.	1	9
Stelechomyia perpulchra	–	1
Tanytarsus sp.	6	4
Thienemaniella fusca	1	1
Tipula sp.	–	3
Ephemeroptera		
Isonychia sp.	–	3
Tricorythodes albilineatus	3	–
Gastropoda		
Pomacea paludosa	1	–
Undetermined gastropod sp.	2	–
Hemiptera		
Metrobates sp.	–	1
Lepidoptera		
Neargyractis slossonalis	–	1

Malacostraca		
Gammarus sp.	2	–
Palaemonetes paludosus	12	10
Procambarus fallax	–	17
Odonata		
Argia tibialis	–	1
Boyeria vinosa	1	–
Enallagma sp.	–	1
Gomphus cavillaris	1	2
Gomphus sp.	2	–
Hagenius brevistylus	–	1
Ischnura sp.	1	–
Macromia sp.	–	2
Oligochaeta		
Limnodrilus hoffmeisteri	1	–
Pelecypoda		
Corbicula manilensis	–	1
Elliptio sp.	–	1
Undetermined Pelecypod sp.	–	1
Sphaerium or *Musculium* sp.	1	–
Villosa amygdala	1	–
Trichoptera		
Cheumatopsyche sp.	4	1
Chimarra sp.	2	–
Hydroptila sp.	1	13
Nectopsyche sp.	–	3
Nyctiophalax sp.	5	–
Oecetis cinerascens	2	–
Oecetis sp.	–	1
Oxyethira sp.	2	–
Polycentropus sp.	1	–
Triaenodes sp.	1	1

Periphyton taxa list and abundances for Feldspar Corporation, Putnam County, Florida, collected on 24 June, 1991.

	Test Site
Diatoms	
Achnanthes clevei	7
Achnanthes exigua	4
Achnanthes hauckiana	11
Achnanthes hustedtii	87
Achnanthes lanceolata	33
Achnanthes lanceolata v. *apicul*ata	4
Achnanthes linearis	11
Achnanthes peregalli v. *parvula*	1
Achnanthes sp.	1
Anomoeoneis vitrea	1
Bacillaria paradoxa	3
Cocconeis placentula	139
Cyclotella meneghiniana	4
Diploneis ovalis	4
Eunotia pectinalis	5
Fragillaria pinnata	2
Gomphonema parvulum	4
Navicula radiosa	12
Navicula viridula	1
Nitzschia amphibia	2
Nitzschia palea	3
Pinnularia major	1
Stauroneis smithii	1
Surirella tenera	1
Synedra ulna	9
Chlorophyta	
Closterium sp.	1
Cyanophyta	
Anabaena sp.	1
Lyngbya sp.	1
Nostoc sp.	1
Phormidium sp.	14

Fill Out This Section For All Surface Water Discharger Inspections (CEI, CSI, CBI, PAI, XSI - RI Optional)

1	2	3	11	12	17	18	19	20
Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
N	5	FL0028525		910528		X	5	2

Remarks

21 66

Fill Out This Section For All Surface Water Discharger Inspections (CEI, CSI, CBI, PAI, XSI - RI Optional)

1	2	3	11	12	17	18	19	20
Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
N	5	FL0028525		910528		B	5	2

Remarks

21 66