



# Reengineering Monitoring Water Conservation Area 2A (WCA-2A) Pilot Project

## Background and Recommendations

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TOC Meeting  
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# Why Reengineer?

- SFER Peer Review Panel request
- Senior Management request
- Recognized inefficiencies and redundancies
- Technological forces
- Cost

# Reengineering Approach

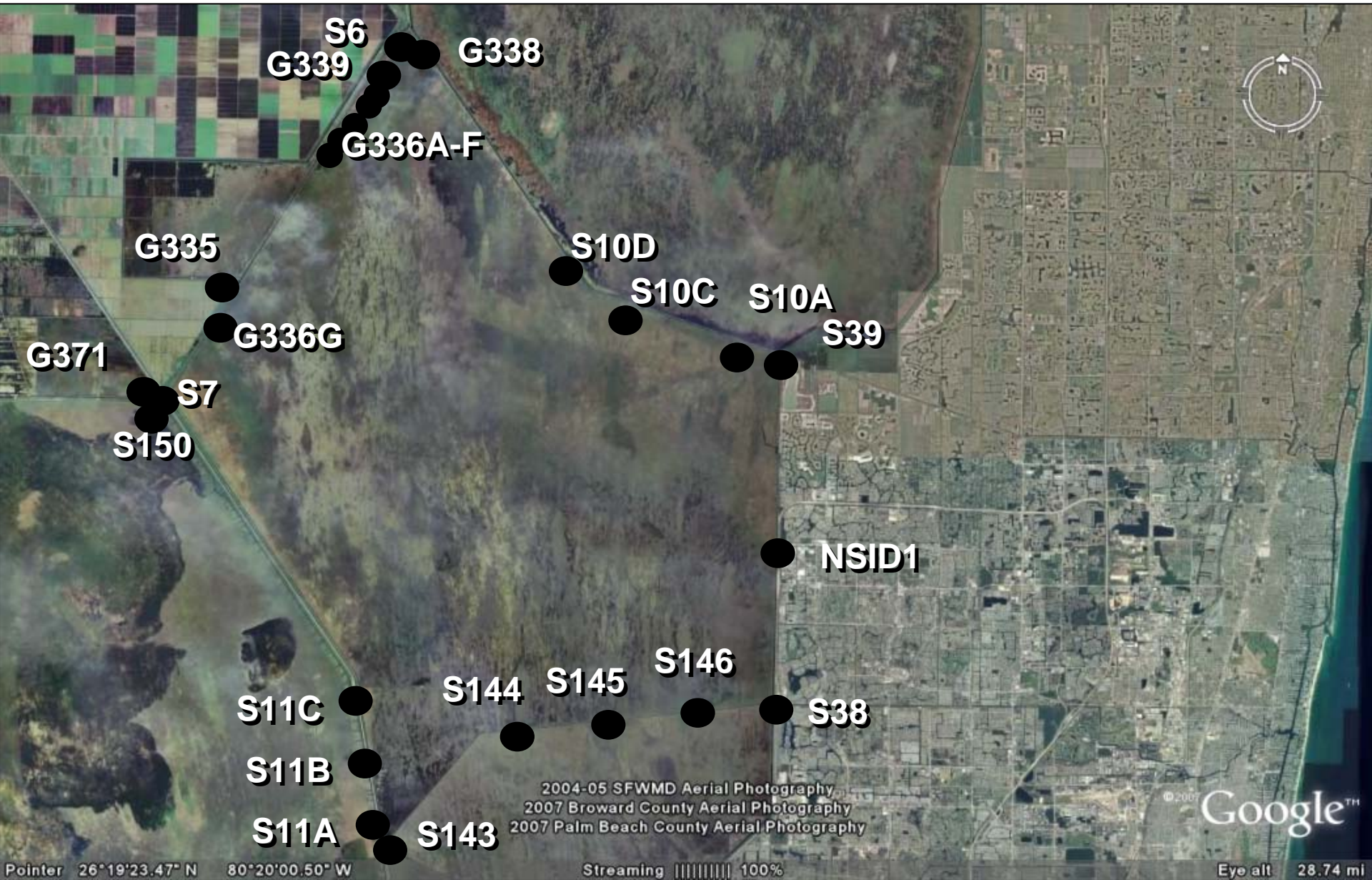
- Select pilot project area (WCA-2A)
- Review mandates/permits (letter and spirit) and determine fundamental management/scientific questions
- Define monitoring objectives and information needs

# Reengineering Approach (cont.)

- Design and rebuild the monitoring network to fulfill objectives and information needs:
  - Develop parameter sets based on logistics, utility and justifiable need
  - Develop frequencies that are logical with respect to environmental variability and data needs
  - Rebuild structure and marsh station sets
    - *Evaluate and integrate new technology*
    - *Logistical considerations*
    - *Review historical data*
    - *Prioritize critical stations*
    - *Give preference to stations with history*



# WCA-2A Structures Overview



# Monitoring at WCA-2A Structures

## Required for:

- Settlement Agreement
- Everglades Forever Act
  - Non Everglades Construction Project (Non-ECP) Permit
  - Stormwater Treatment Area (STA) ECP Permits
- NPDES Permits
- EAA Rule 40E-63
- Hypothesis-driven Research
- Modeling support
- Agency's Mission

# WCA-2A Structure Mandates

Structure	Settlement Agreement CAMB	Settlement Agreement New Delivery	Non-ECP Permit	STA 2 Permits	STA 3/4 Permits	EAA Rule	Everglades Regulation Support
S39	X		X				
S10A	X						
S10C	X						
S10D	X						
NSID1	X						X
S6	Y			X		X	
G338		Z		X			
G339		Z		X			
G336A-F		Z		Z			
G336G and degraded levee		Z		Z			
S7	X				X		
G371					X	X	
S150	X						
S11C	X						
S11B	X						
S11A	X		W2				
S143	X		W1				
S144	W1		X				
S145	W2		X				
S146	W1		X				
S38	X		X				

X= monitoring required by this mandate

W1= monitoring for this station uses a surrogate

W2= surrogate station triggered off of one or more structures

Y= applicability of this mandate is open to interpretation

Z= station is subject to this mandate but no monitoring has been propagated



# Current Structure Monitoring

- The primary objective of monitoring is to ensure that discharges meet water quality standards and nutrient loads are quantified
- Currently samples are collected when flow is observed or at monthly defaults
- Some structure data used to support marsh modeling and research



# Is the current sampling design capturing all the needed data?

- 50% of all flows through the S10s are sampled within 7 days of initiation of discharge
- 20% of all flows are collected between 7 and 14 days of initiation of discharge
- 30% of all flows are not sampled within two weeks

# Proposed structure monitoring strategy: Recorded Flow

- Suggest changing from direct observation-based collection to telemetry-based collection using electronic databases to screen stations before staff deployment
  - Supports monitoring of discharges for compliance
  - A quantum step in efficiency and increased useful data collection

# Recorded Flow (RF)

- On the day of collection,
  - If no flow has occurred in the last two weeks, then the station is not visited
  - If flow has occurred, then the station is visited and samples collected
- At a review frequency of biweekly, this process will actually increase the number of useful samples collected, but has the potential to decrease the number of station visits



# At what frequency should databases be checked?

- For stations with autosamplers the frequency should be weekly to meet maintenance requirements
- For other stations, staff and travel logistics were analyzed
  - Monthly created the potential for too many stations in too few trips
  - Weekly created the potential for too many trips with too few stations
  - Biweekly appears optimal and allows trips and staff to be staggered

# How will flow be discerned?

- Actual or provisional flow data may not be available in real-time or even within two weeks
- Pumping or structure opening combined with headwater and tailwater readings can be used to determine structure openings and flow
- Any flow event will trigger a sampling regardless of magnitude
  - Protective of the system

## How would recorded flow improve data collection (theoretically)?

- In 2004, S10A and S10C were sampled BWF
  - 26 trips, 52 station visits, 13 samples
  - 25% result to effort ratio
- If we apply a BWRF protocol
  - 10 trips, 19 station visits, 19 samples
  - 100% result to effort ratio
- 46% increase in useful data
- 62% decrease in sampling trips
- 63% decrease in station visits



# How does recorded flow impact monitoring requirements?

- Virtually guarantees a sample within two weeks of a flow event
- Meets the primary objective of monitoring to meet standards
- Should eliminate the need for monthly default monitoring
- Monthly monitoring for other purposes should be considered on a case by case basis

# Develop Parameter Set for all Stations

## Considerations:

- Justifiable need
- Utility
- Logistical considerations
- Should the parameter set be standardized or variable?

# Develop Parameter Set for all Stations

- Staff believe that parameter sets that vary greatly from station to station create confusion and potential errors
- Parameter costs are relatively low in comparison to sampling costs
- Standardized parameter sets are more efficient
- Standardizing parameters into two sets may help reduce error
  - Compliance Set for flow events
  - Modeling Set for select stations in models that need routine data



# Compliance Set

- **Field Measurements**

- Depth
- Specific Conductivity
- Temperature
- pH
- DO

- **Nutrients**

- TPO4
- TDPO4
- OPO4
- TKN
- TDKN
- NOx
- NH4
- TOC
- DOC

- **Ions**

- Ca
- Mg
- Na
- K
- SO4
- SiO2
- Cl

- **Other**

- TSS
- Alkalinity
- Fe (Q)

# Modeling Set

- **Field Measurements**
  - Depth
  - Specific Conductivity
  - Temperature
  - pH
  - DO
- **Nutrients**
  - TPO4
  - OPO4
  - TKN
  - NOX
- **Ions**
  - SO4
  - Cl

# Reengineering Structure Monitoring

- **Consider**
  - Local conditions
  - Historical data
  - Impact of Adjacent Stations
  - Logistical Issues
  - Monitoring Objectives



# Station Subsets

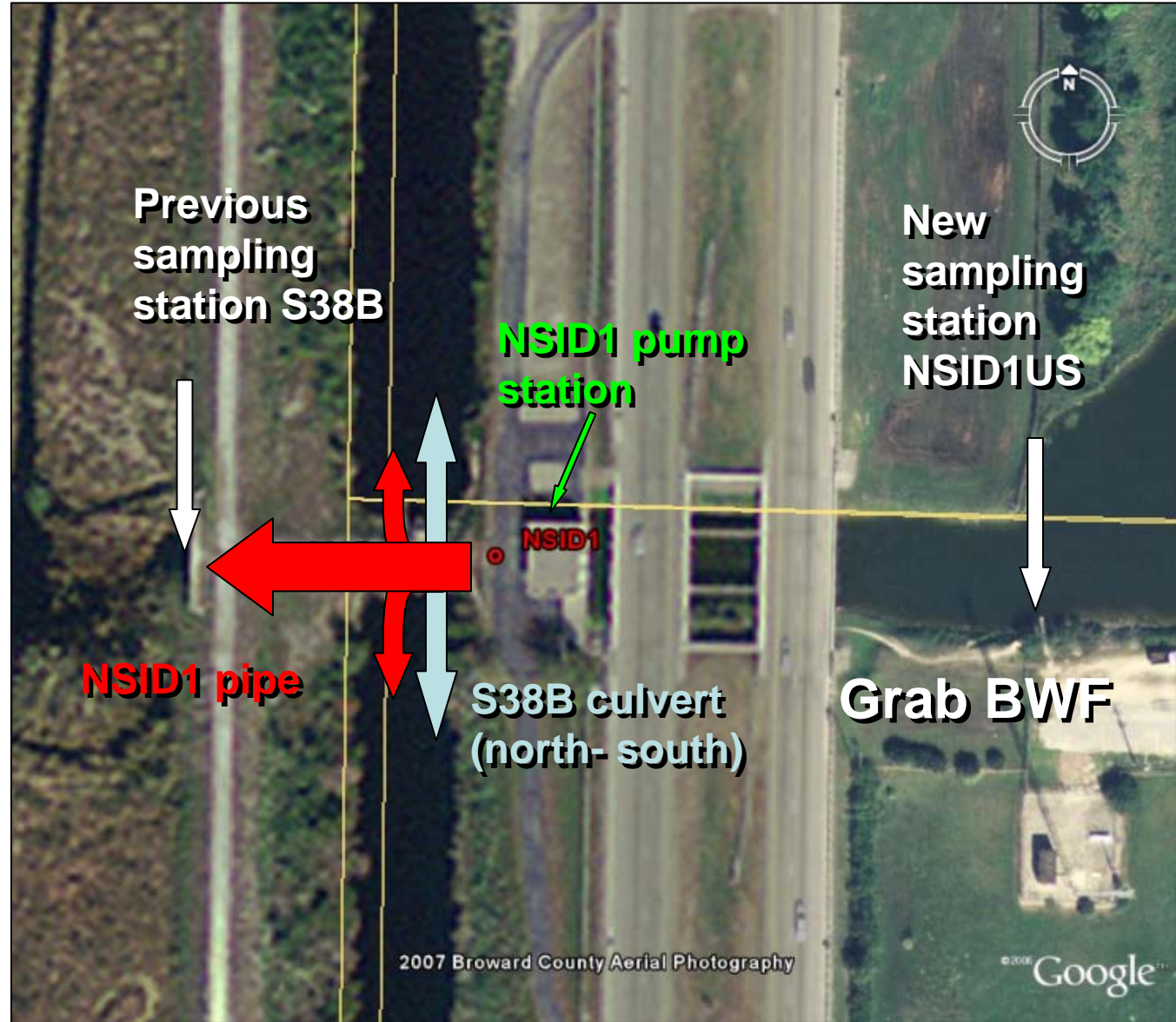
- **Inflows**

- From WCA1
  - S10s
  - Related structure S39
- From EAA/STAs
  - S7, S6, and S336s
  - Related structures G371 and S150
- From Suburban Areas
  - NSID1

- **Outflows**

- To WCA3A
  - S11s
- To WCA2B
  - S144, S145, S146
- To Suburban
  - S38
  - S143

# NSID1 Existing Monitoring

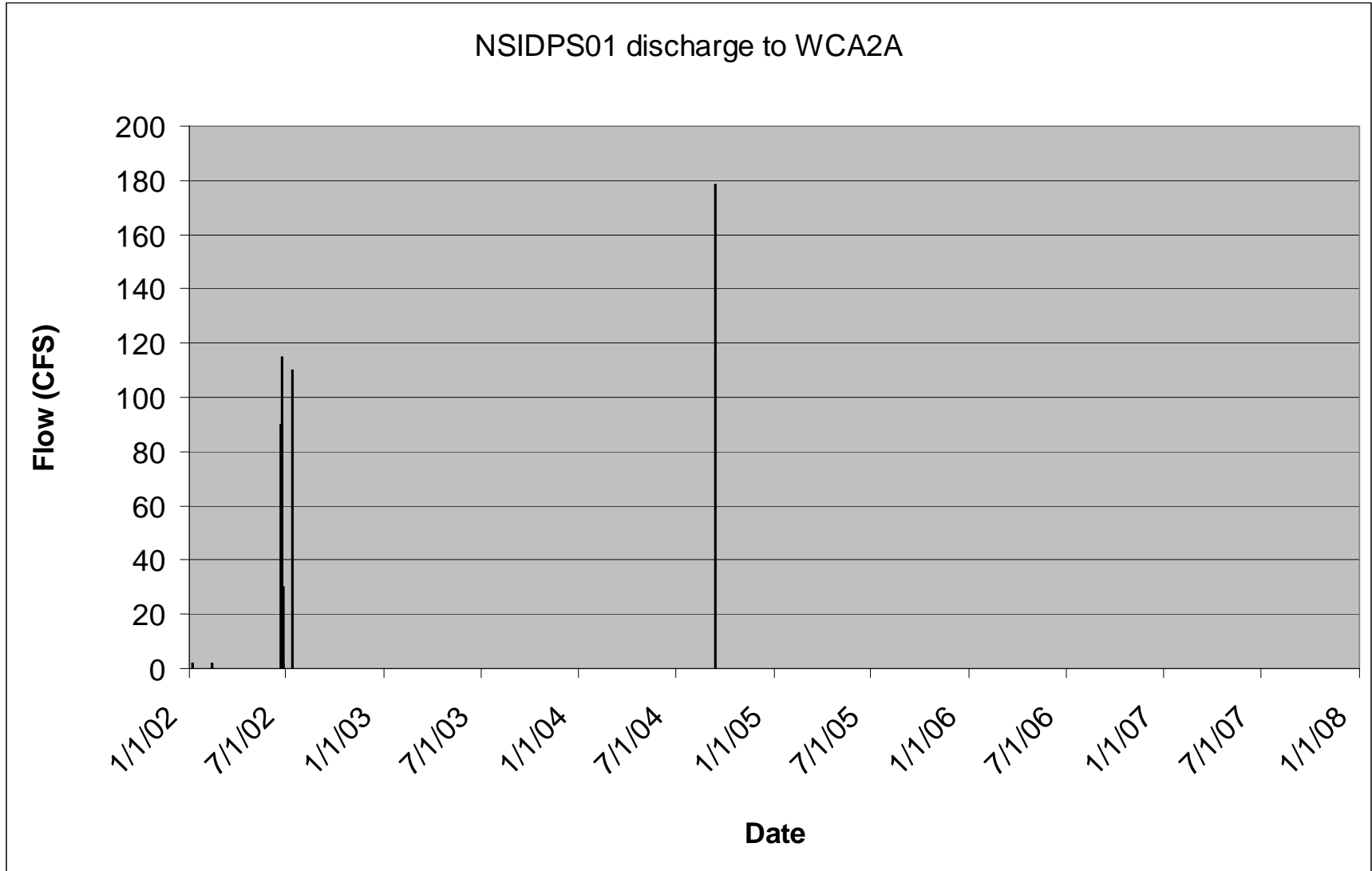


# NSID1 Discussion Points

- NSID1 is a minor pump station that occasionally discharges from suburban area into WCA-2A
- Sampling challenges due to configuration of infrastructure
- Biweekly grab sample required by Settlement Agreement when flowing from discharge pipe
- Since structure is owned by NSID, data not readily available in District Database (60 day lag)



# Limited Discharges to WCA2A



# *Recommended Actions*

- ✓ Change frequency to BWRF
  - ✓ Direct phone call to NSID
  - ✓ Sample only when discharging to WCA-2A

# NSID1 Proposed Monitoring



New  
sampling  
station  
NSID1US

Grab BWRP

S38B

NSID1



# L35B Area Existing Monitoring



\* Samples are collected at S145 if S144, S145, or S146 are flowing.

# Discussion Points

- L-35B levee begins at S38 and ends at S11A
  - one lane with little space for turnaround
- S145 serves as a surrogate for S144 and S146
- S38 is a discharge from the Everglades Protection Area

# *Recommended Actions*

- ✓ Sample S38 and S145  
(as a surrogate for S144 and S146)  
BWRF using the compliance set



# L35B Area Proposed Monitoring



**\* Samples are collected at S145 if either S144, S145, or S146 are flowing.**



# S11 Area Existing Monitoring



# S11A/S143 Discussion Points

- S11s serve as inflows to WCA-3A
- Average TP during 2000-2006
  - S11C 29 ug/L
  - S11B 22 ug/L
  - S11A 24 ug/L
- S11A (BWF) currently serves as a surrogate for S143 which is BWF/M (Non-ECP)
- S143 is a discharge from the EPA



# *Recommended Actions*

- ✓ Use S11A as a surrogate for S143
- ✓ Sample S11A, B and C BWRF using the compliance set

# S11 Area Existing Monitoring



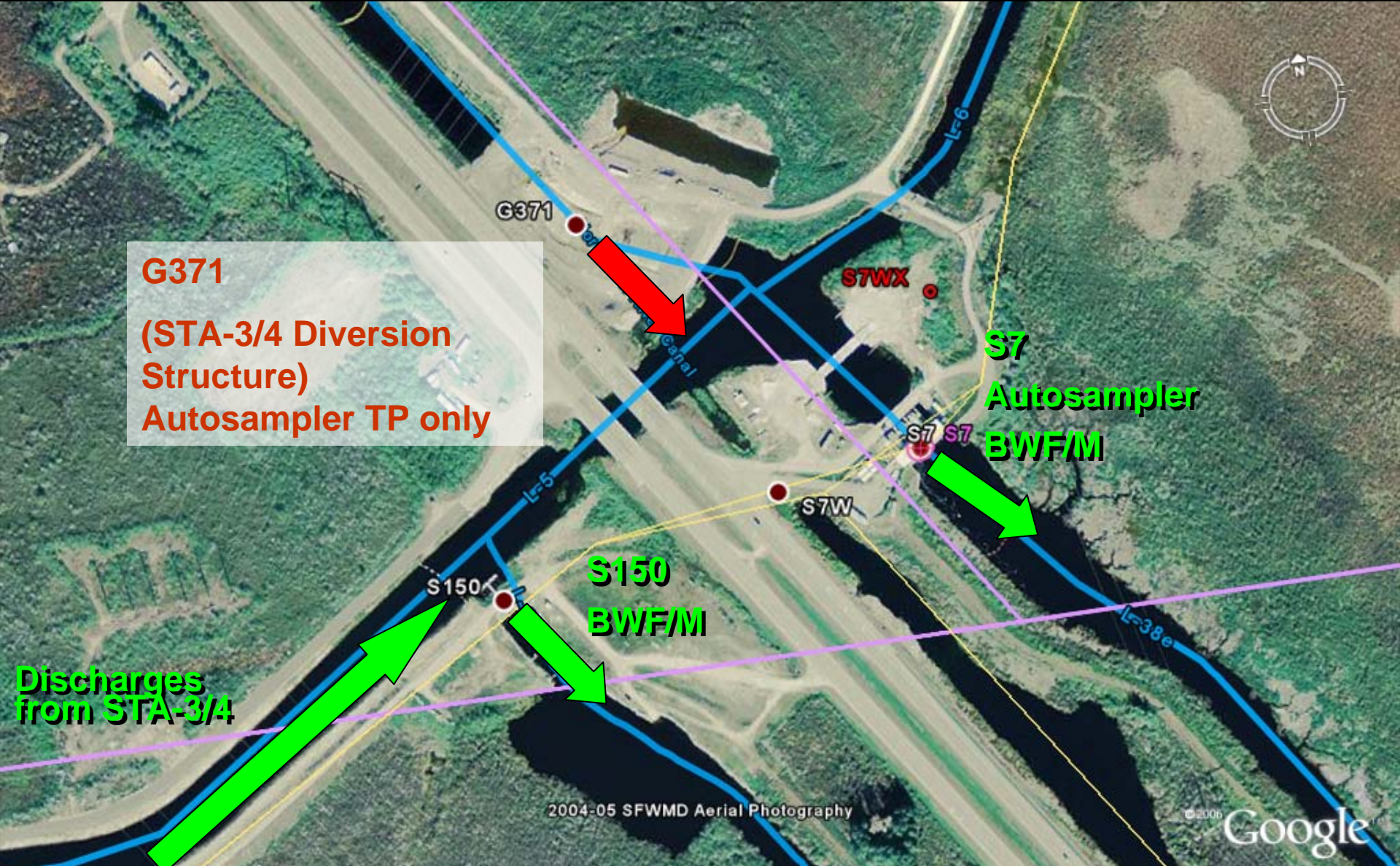
\* Samples are collected at S11A if either S11A or S143 are flowing, otherwise monthly

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# S7 Area Existing Monitoring





# Discussion Points

- Recently modified infrastructure and drought means little information on how the current system functions
- S7 and S150
  - Sourced either from STA-3/4 or G371
  - Flows from STA-3/4 to S7 must pass S150
  - Grabs collected BWF/M
  - S7 autosampler (TP & TN)
- G371
  - Not under the Settlement Agreement
  - Diversion operations for STA-3/4 (limited use)
  - EAA Rule autosampler (TP) requires weekly maintenance
    - District staff are working to modify the requirement for an autosampler

# S7 TP Data

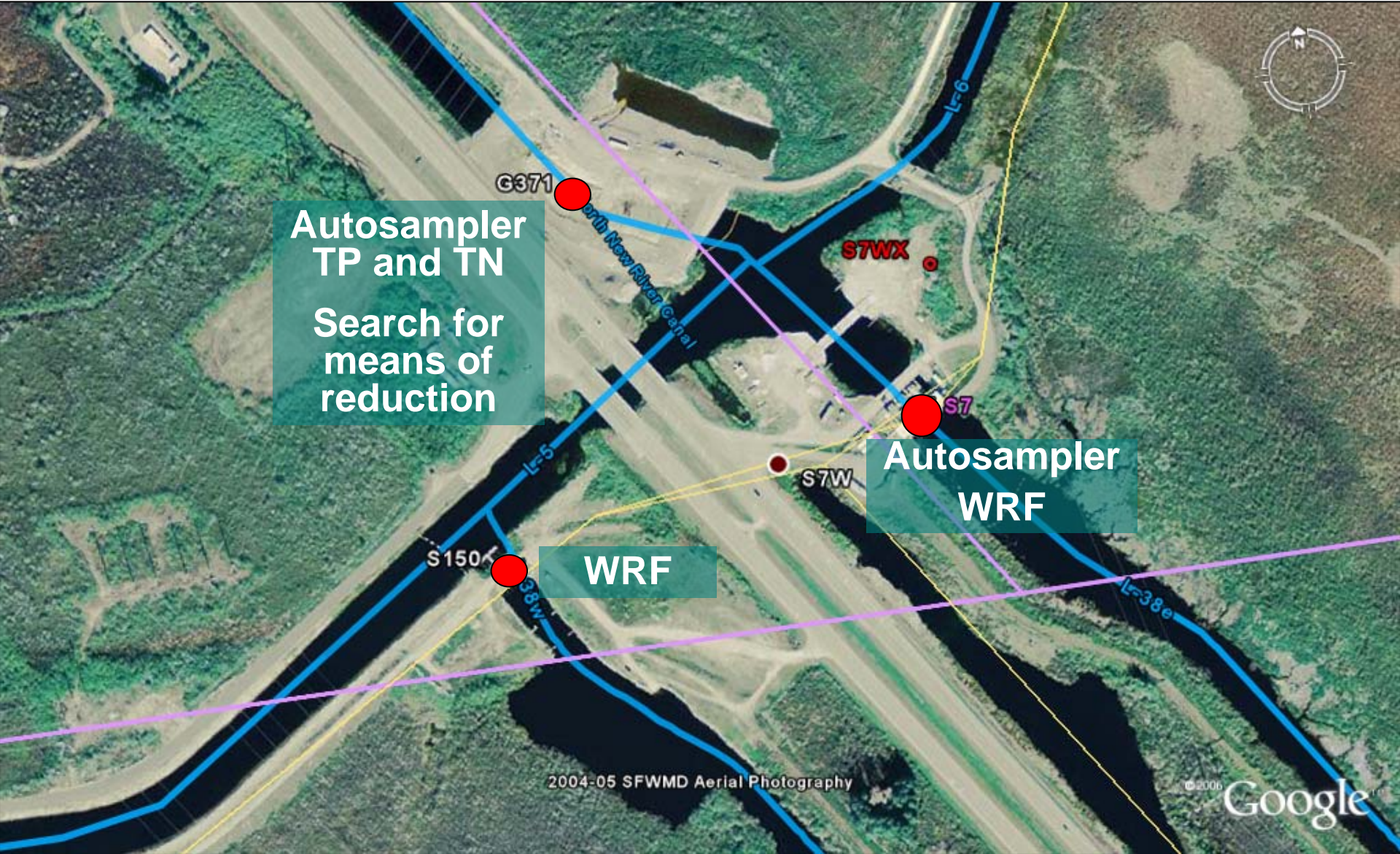
- S7 TP samples collected within 14 days of a flow event (median = 33.0 ug/L) are significantly different and higher than non-flowing samples (25.5) and all samples (29.0)
- Suggests there is no first flush effect
- Suggests that going to monitoring within 14 days of a flow event will be closer to peaks than non-flowing data

# *Recommended Actions*

- ✓ At G371
  - Add TN to autosampler
  - Search for short term fix to autosampler maintenance requirements
  - Develop long-term plan to revise autosampler monitoring requirements of infrequently used structures
- ✓ Retain autosampler at S7
- ✓ Change S7 and S150 to WRF using compliance set
- ✓ Review collected data every two years to see how S7 and S150 compare and how they respond to normal STA operations



# S7 Area Proposed Monitoring

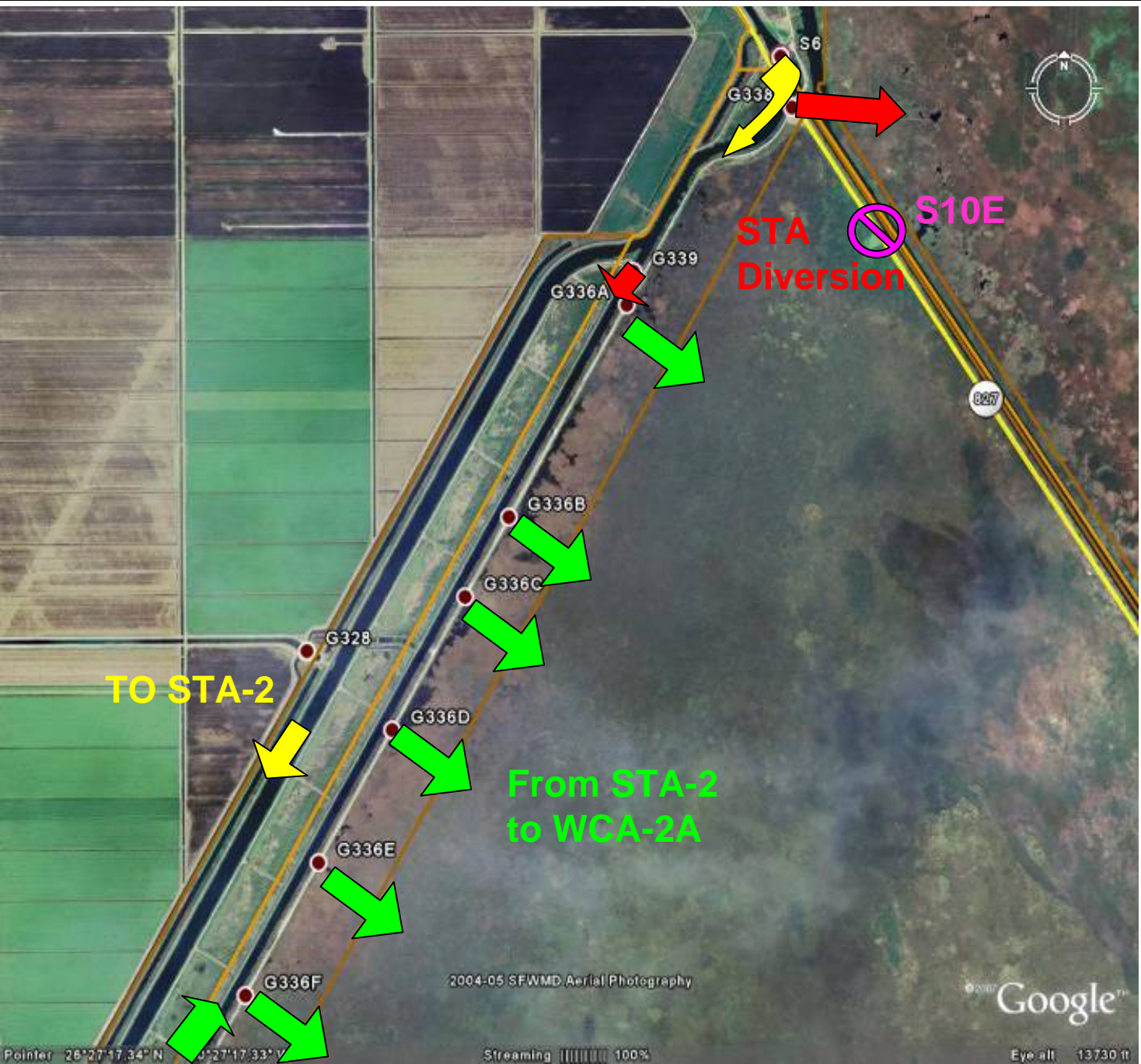


**Autosampler  
TP and TN  
Search for  
means of  
reduction**

**Autosampler  
WRF**

**WRF**

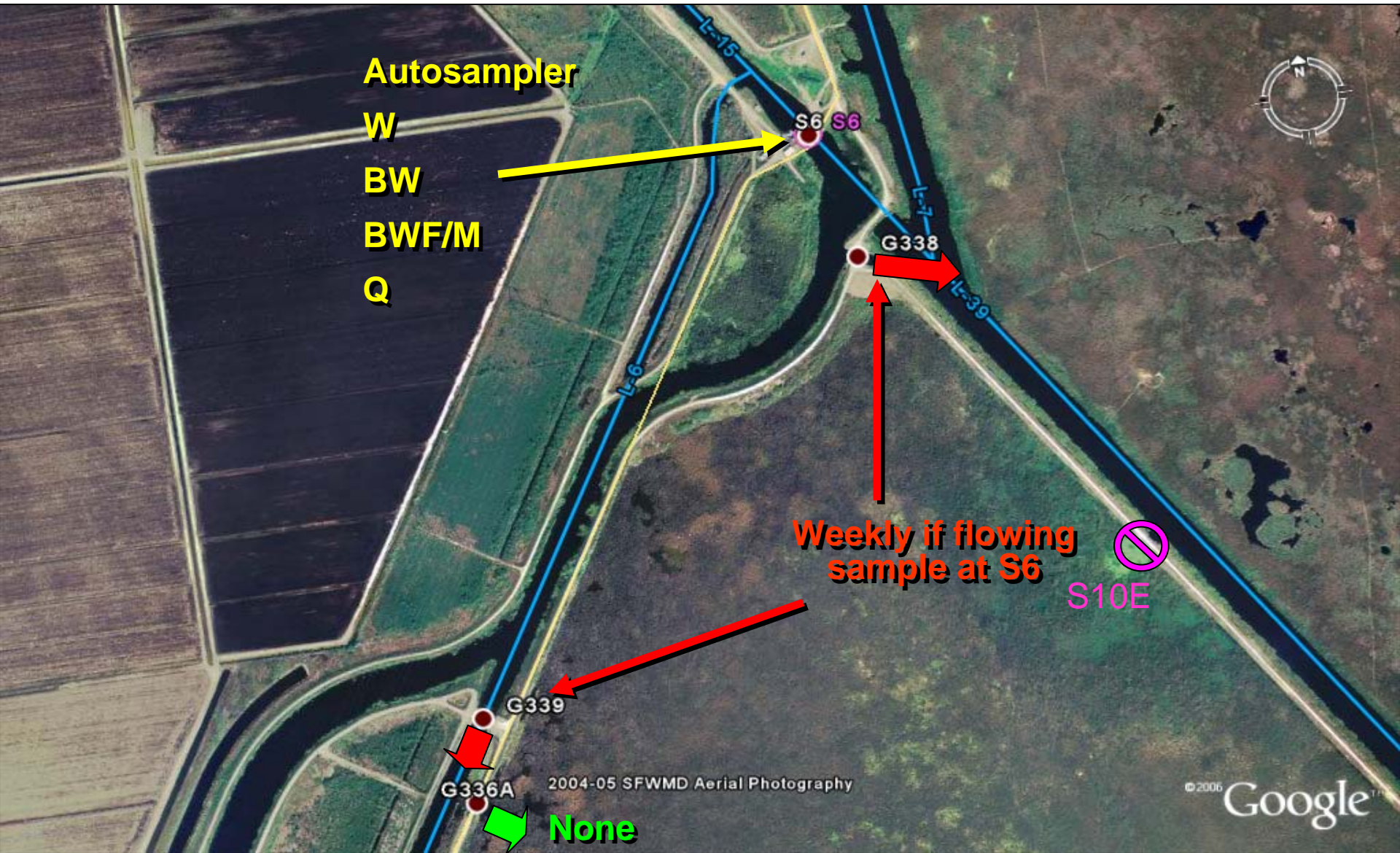




# S6 Area Overview



# S6 Area Existing Monitoring





# Discussion Points

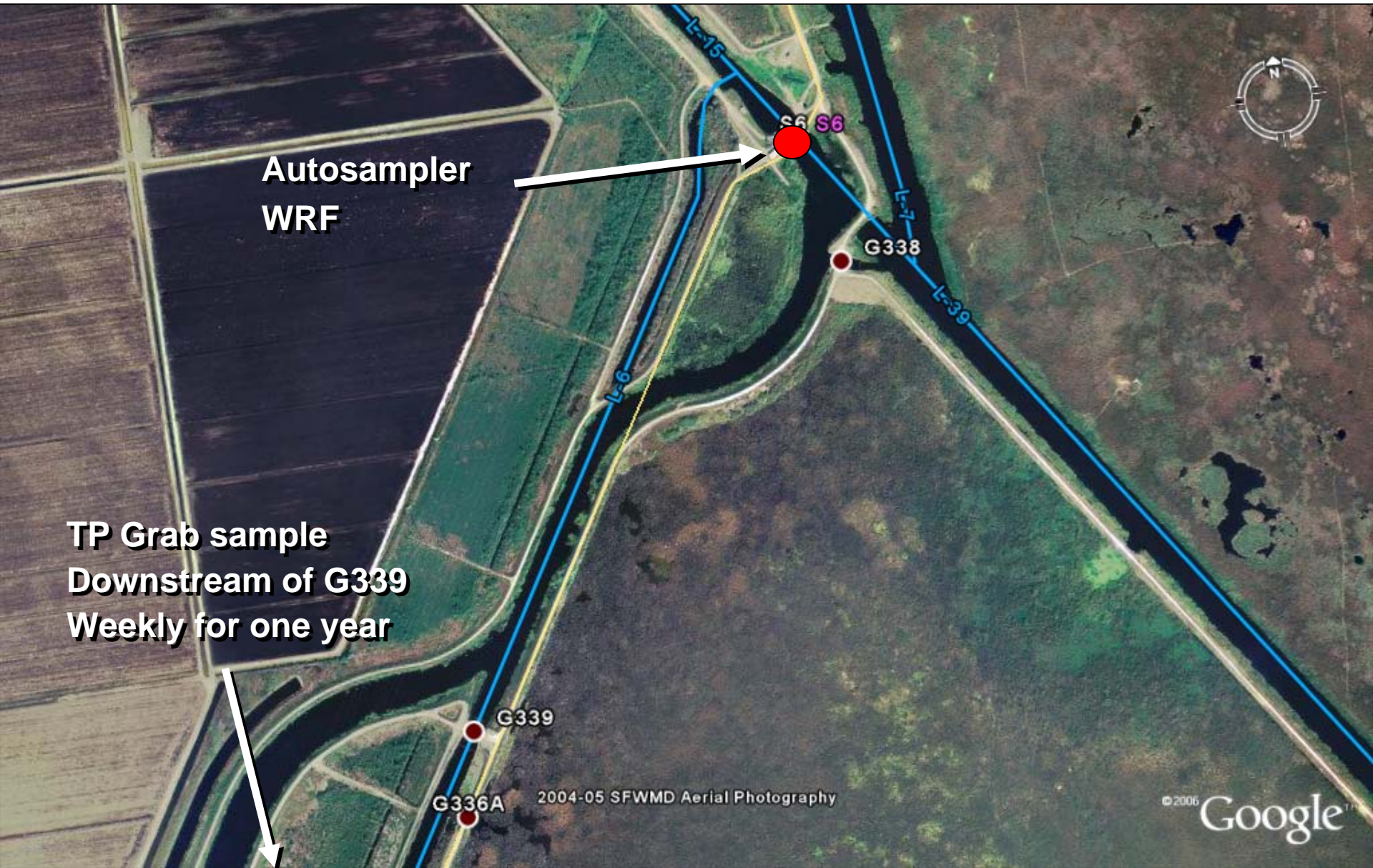
- Data associated with flows at S6 is needed for calculating loads to STA-2 and Everglades Agricultural Area (EAA) Rule (autosampler required)
- S6 part of CAMB in 1991 so was part of Settlement Agreement, but modified and no longer directly discharges to Everglades Protection Area (EPA)
- G336s, G338 and G339 are direct discharges to the EPA so technically under the purview of the Settlement Agreement
- If G338 and G339 are used the STA-2 NPDES permit requires weekly TP monitoring at S6 which can be combined with flow at G338 and G339 to determine loads to the EPA
- G336s not directly monitored, discharges from STA-2 (or if under diversion S6) used as surrogates

# *Recommended Actions*

- ✓ Retain S6 autosampler
- ✓ At S6 eliminate W, BW, BWF/M, Q monitoring sets and switch to a WRF compliance set
- ✓ Begin sampling downstream of G339 for TP only for at least one year, validate that STA-2 discharges are representative of what is reaching G336s



# S6 Area Proposed Monitoring



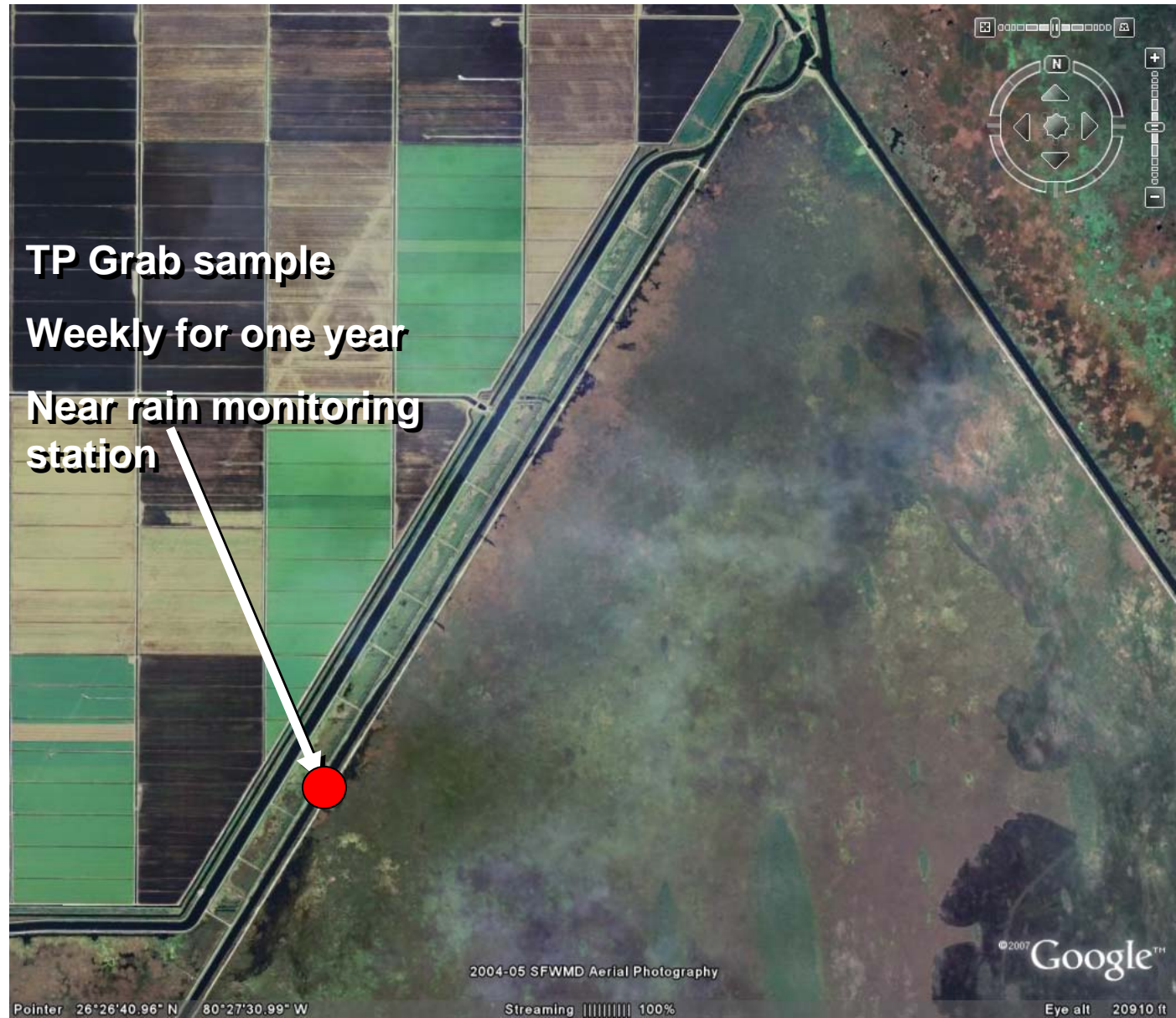
Autosampler  
WRF

TP Grab sample  
Downstream of G339  
Weekly for one year

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# G336 Proposed Monitoring



# S10 Area Existing Monitoring





# S10 Discussion Points

- Data associated with flows is needed for calculating loads to WCA-2A
- Data associated with non-flowing conditions is used for modeling
- It has been suggested that failure to collect non-flowing data may compromise estimates of loading because of missing first-flush effect



# Is there any evidence of a first flush effect?

- S10D
  - TP samples collected within 14 days of a flow event (median = 64.5 ug/L) are significantly different and higher than non-flowing samples (43.0) and all samples (47.5)
  - Suggest no first flush effect
  - Suggests that going to monitoring within 14 days of a flow event will be closer to peaks than non-flowing data

# *Recommended Actions*

- ✓ Sample for compliance at S39 and S10A, C and D BWRF
- ✓ Sample for modeling parameters otherwise monthly

# S10 Area Proposed Monitoring



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# Implementation

- TOC approval is just one step
- Modifications to permits (ECP and NECP) required
- May take three months to a year to fully implement
- Will keep TOC updated on progress and problems

# How will this design impact sampling effort and data collection?

- Excluding autosampler sites S6 and S7
- In 2004, all other WCA-2A structures
  - 286 station visits, 127 samples
  - 44% result to effort ratio
  - Approximate collection costs \$20K
- If we apply the suggested design
  - 156 station visits, 156 samples (estimated)
  - 100% result to effort ratio
  - 23% increase in data
  - 46% decrease in station visits
  - Approximate collection cost savings \$15K



# Summary

- The District seeks approval to modify monitoring of structures around WCA-2A
  - No changes to autosamplers at S6 and S7
  - WRF
    - S6, S7, S150
  - BWRF (compliance set)
    - NSID1, S38, S11A(S143), S11B, S11C, S145(S144,S146)
  - BWRF/M (compliance/modeling sets)
    - S38, S39, S10A, S10C, S10D
  - Weekly for at least one year at a suitable station near the G336 culverts
- Maintain compliance sampling, generate more data, while at the same time lowering costs

# Discussion

