AFIRST

ALTAMONTE – FDOT INTEGRATED REUSE & STORMWATER TREATMENT

PRESENTED BY

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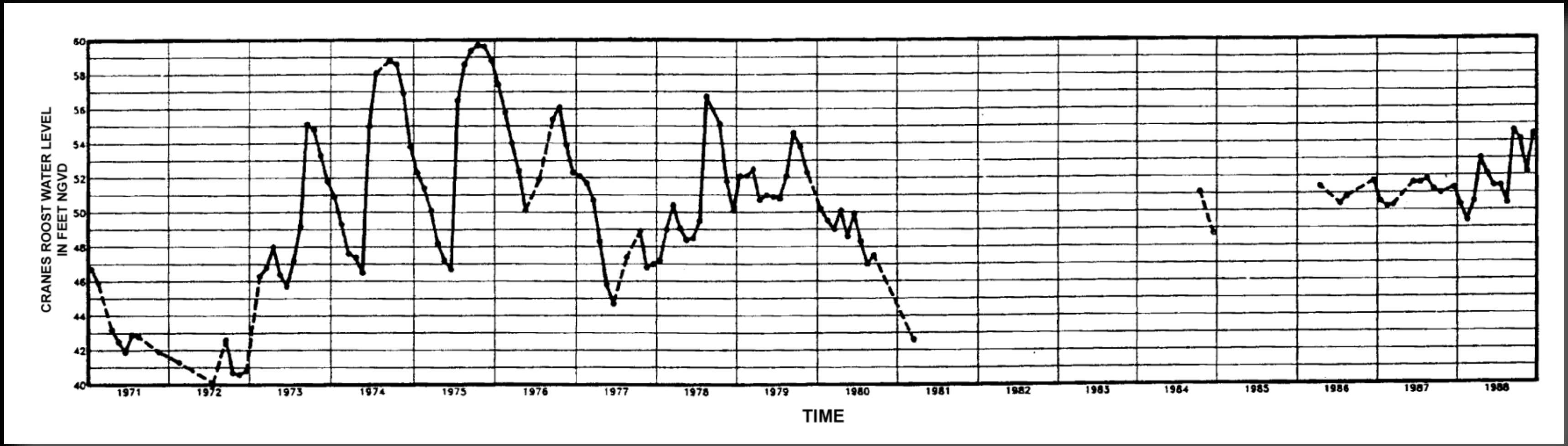
DEVO SEEREERAM, PH.D., P.E.

AFIRST Altamonte Springs-FDOT Integrated Reuse and Stormwater Treatment

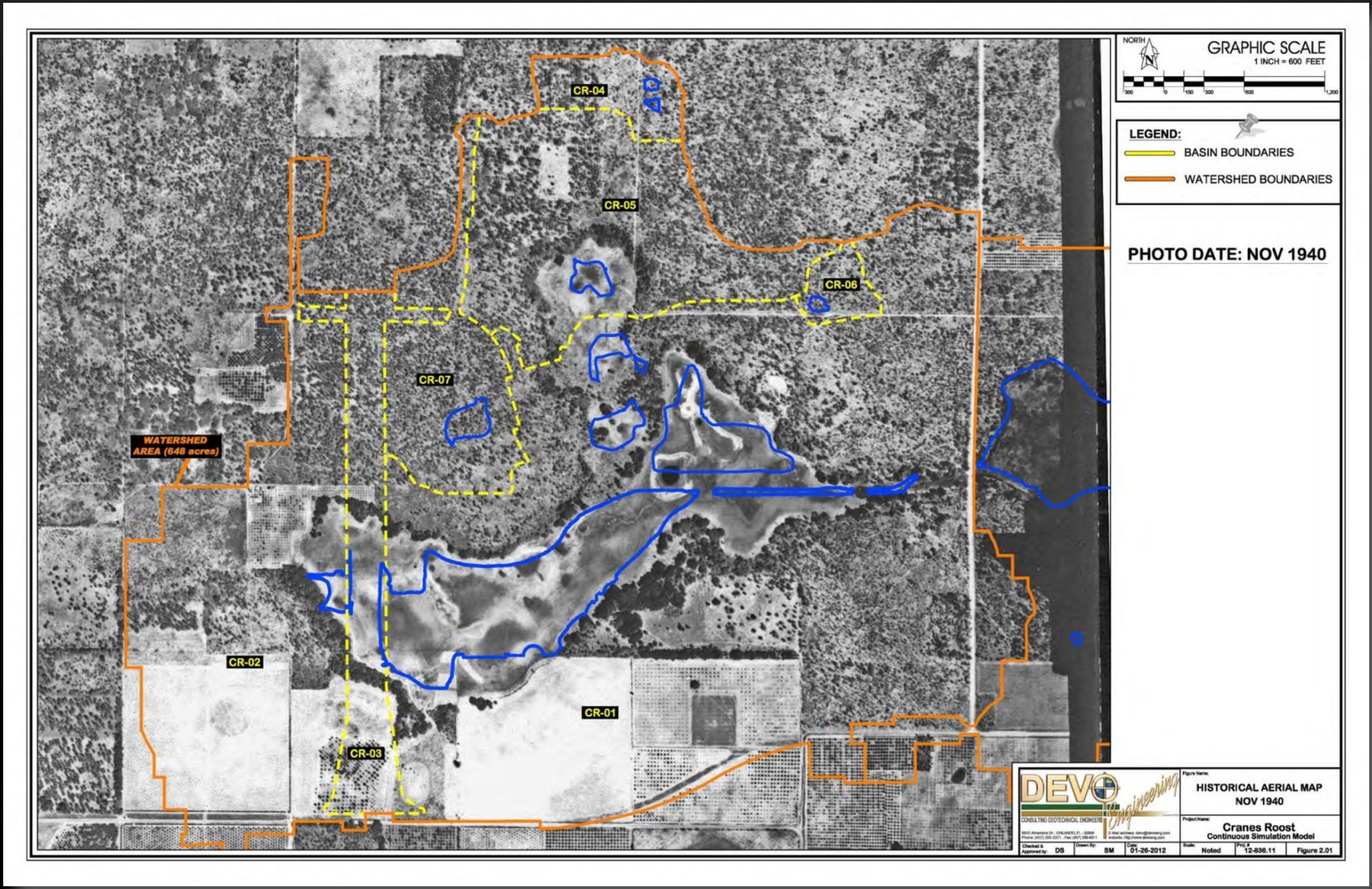
DEVO Engineering

Historic Aerials

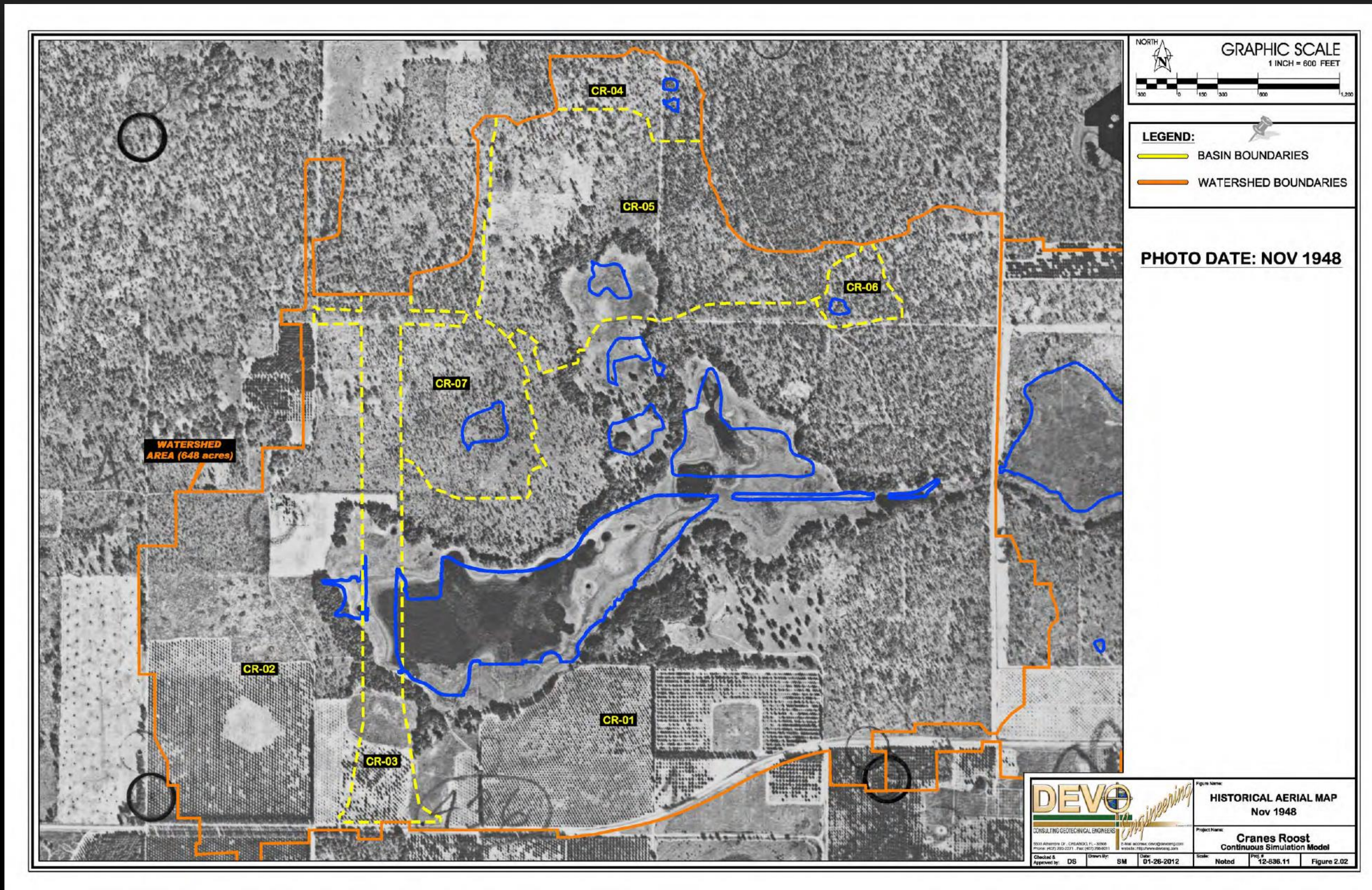
WATER LEVEL IN CRANES ROOST (1971 – 1988)



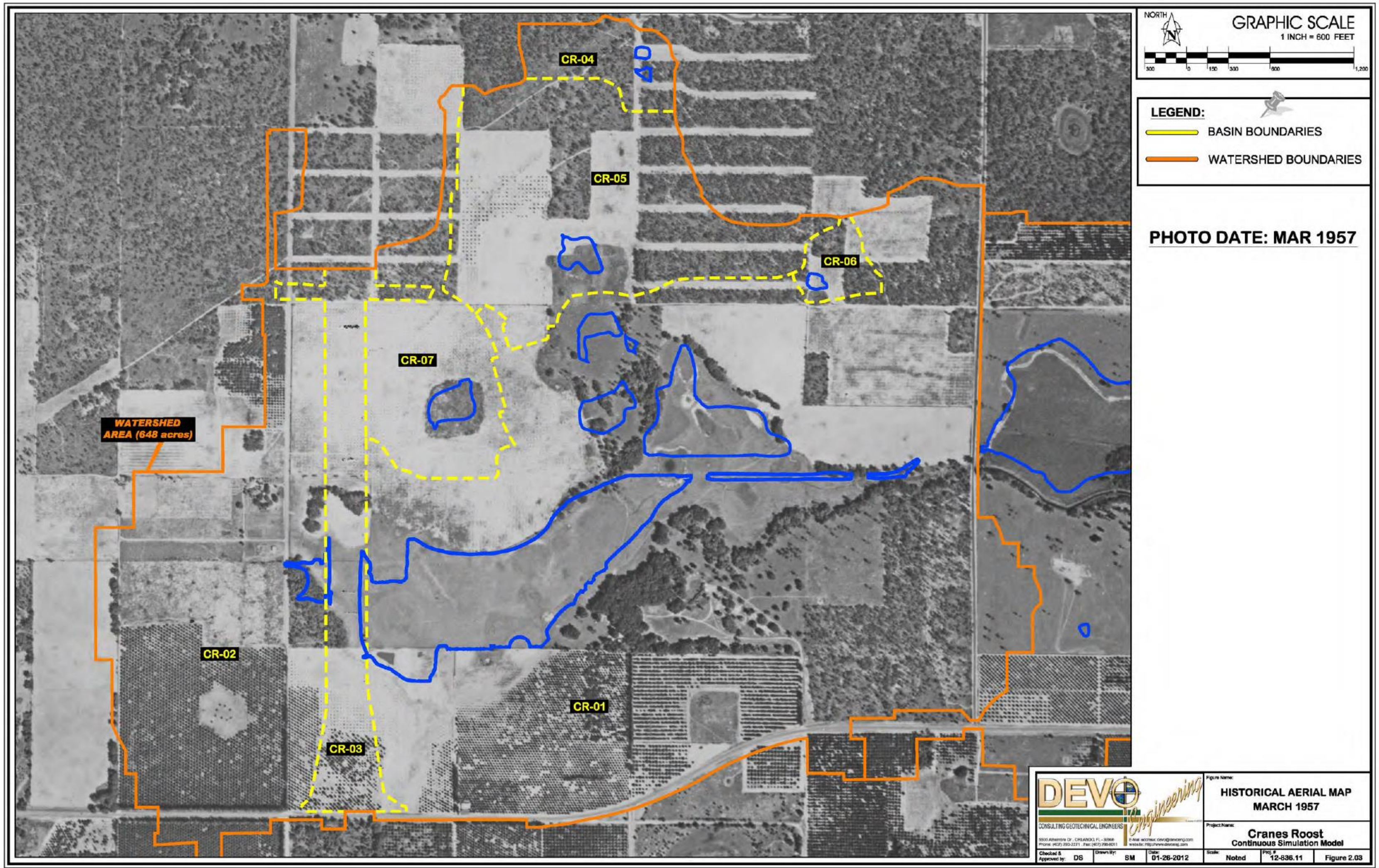
Historic Aerial - Cranes Roost, 1940



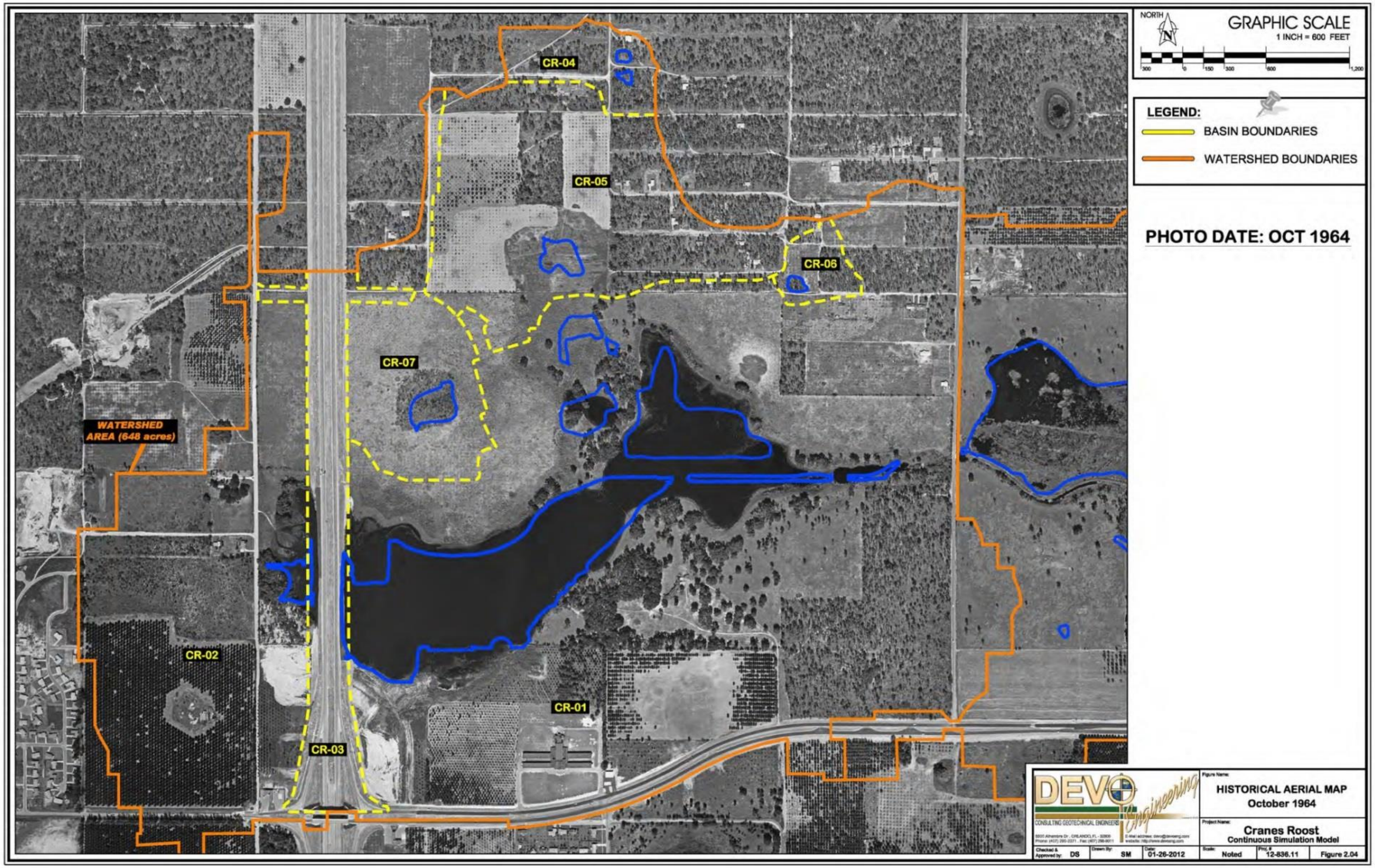
HISTORIC AERIAL - CRANES ROOST, 1948



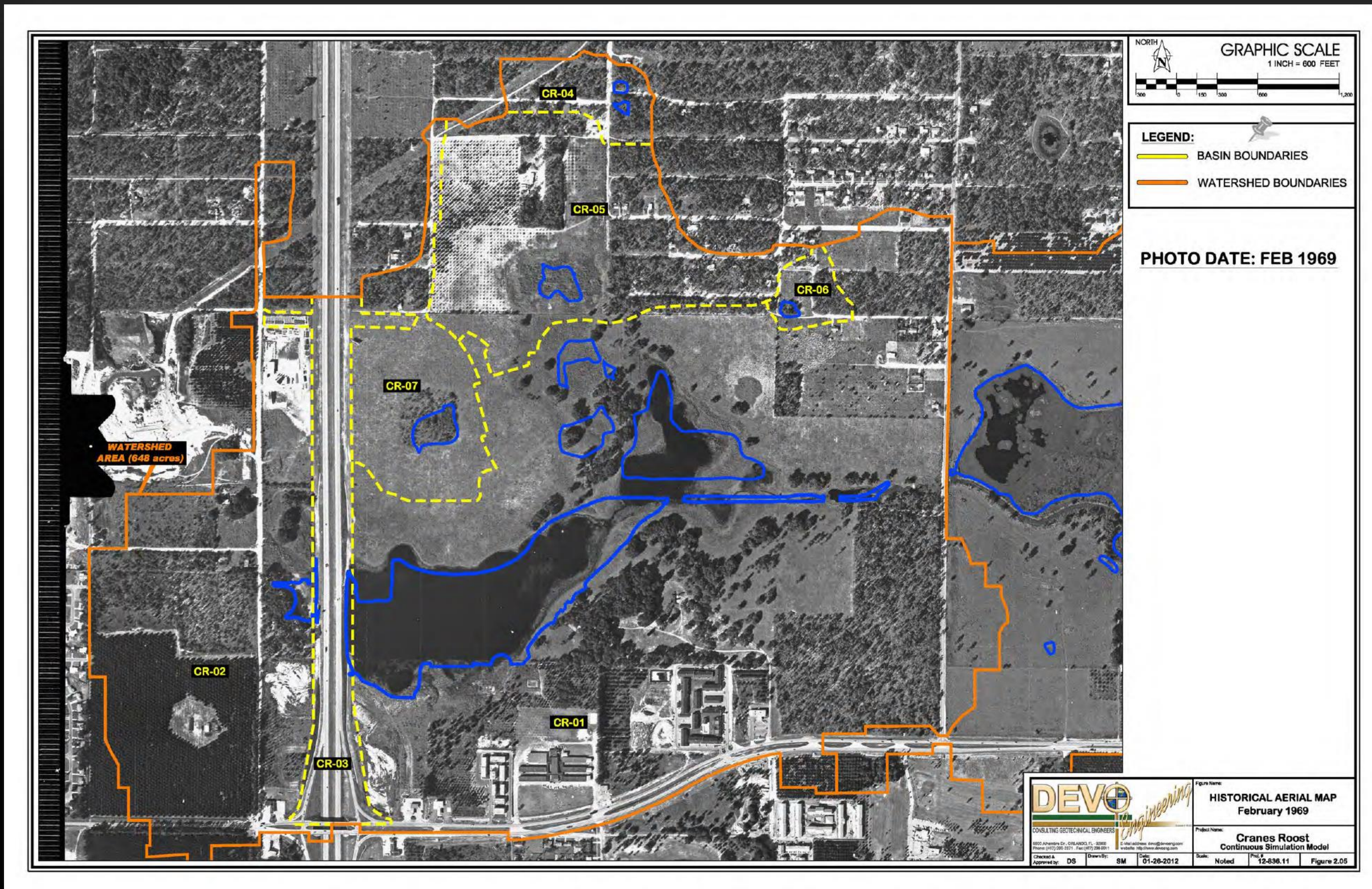
Historic Aerial - Cranes Roost, 1957



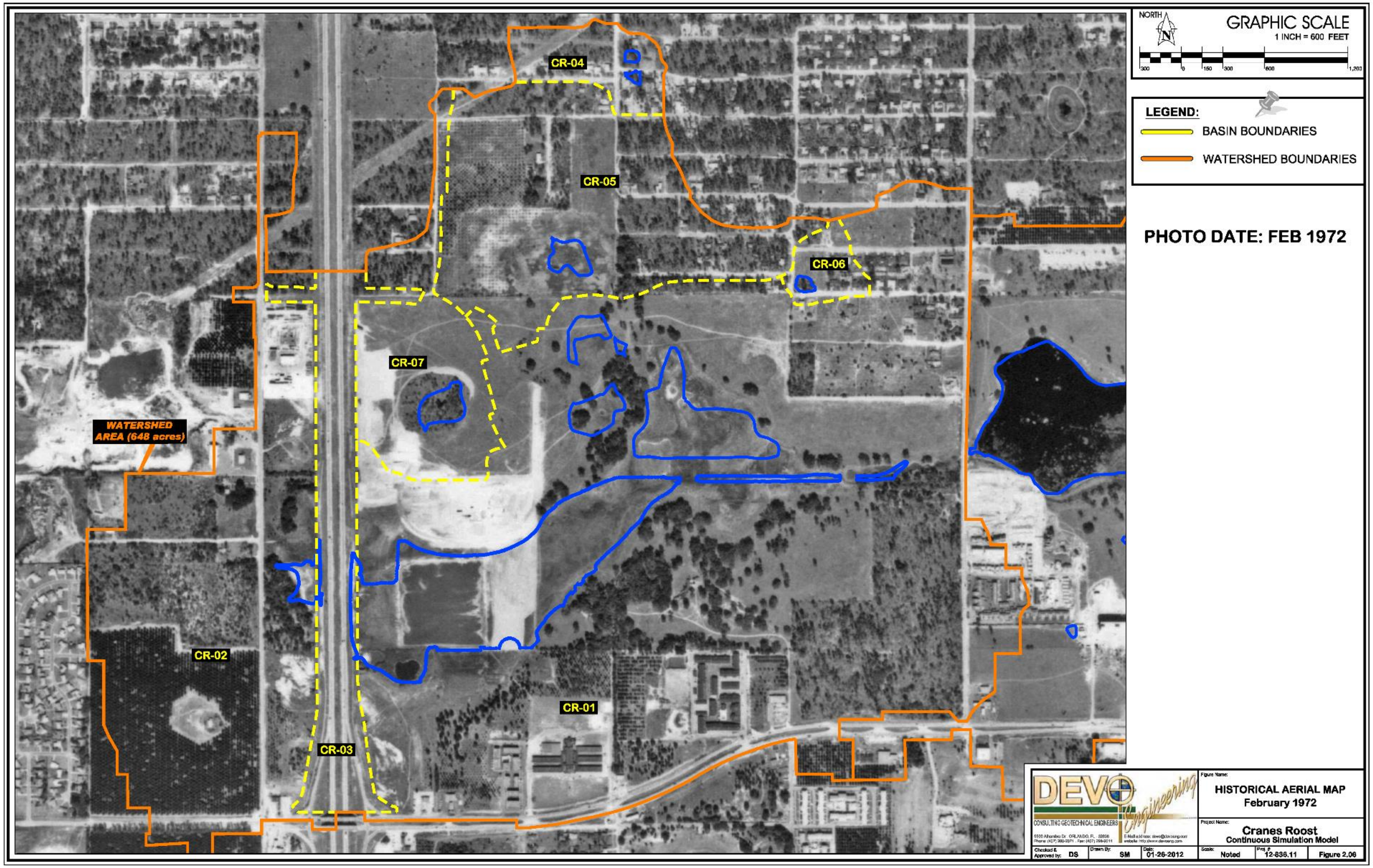
HISTORICAL AERIAL - CRANES ROOST, 1964



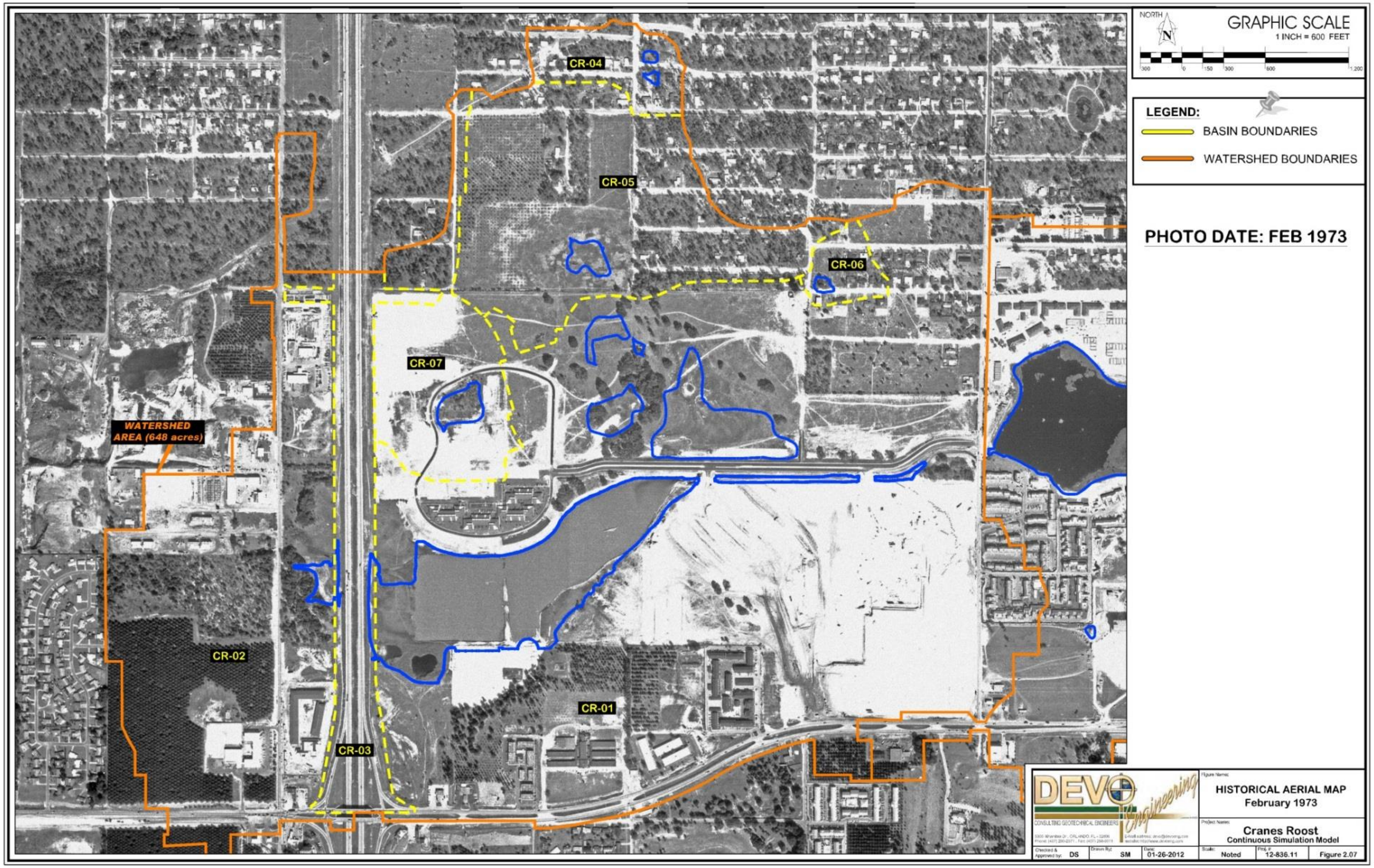
Historical Aerial - Cranes Roost, 1969



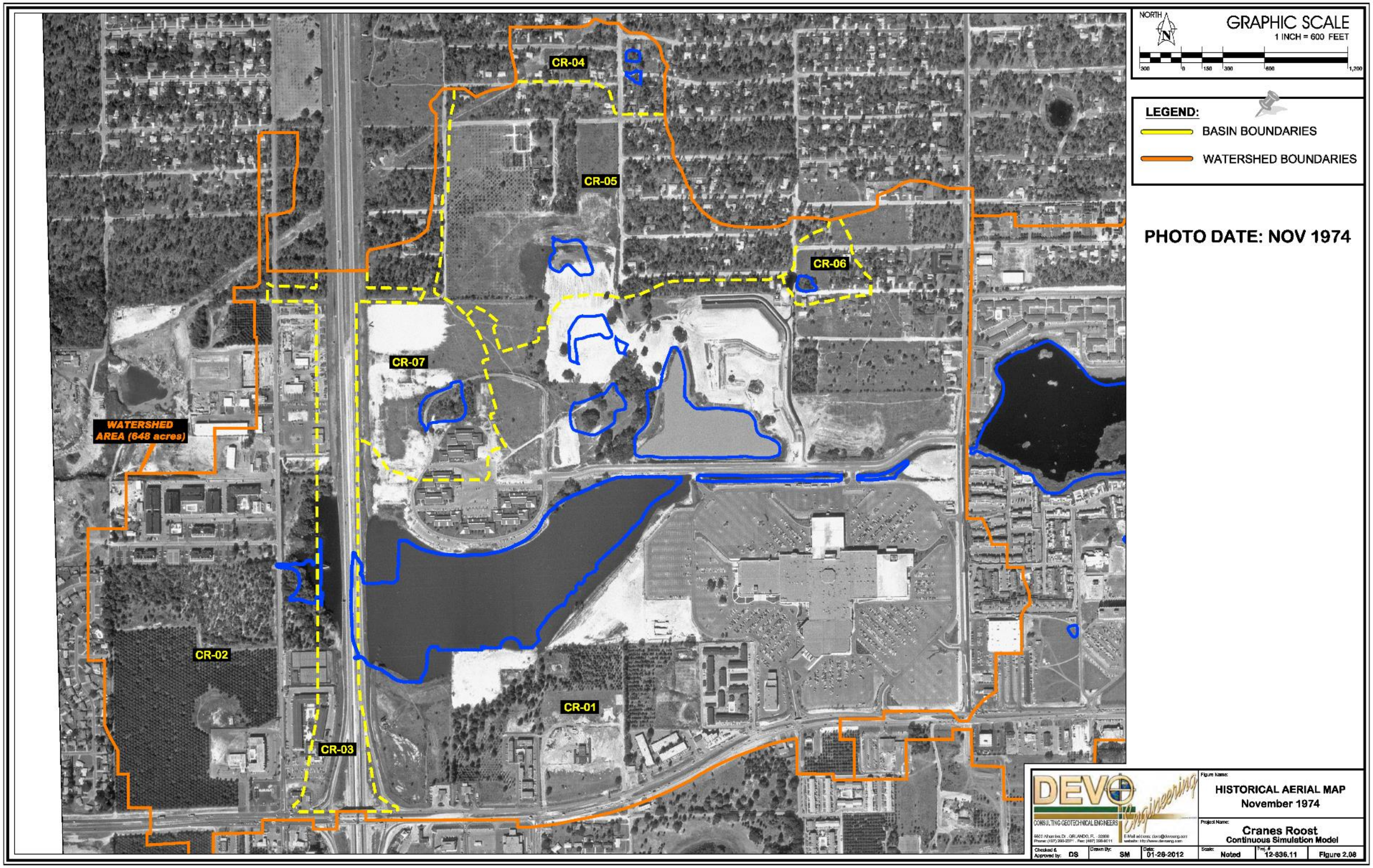
HISTORICAL AERIAL - CRANES ROOST, 1972



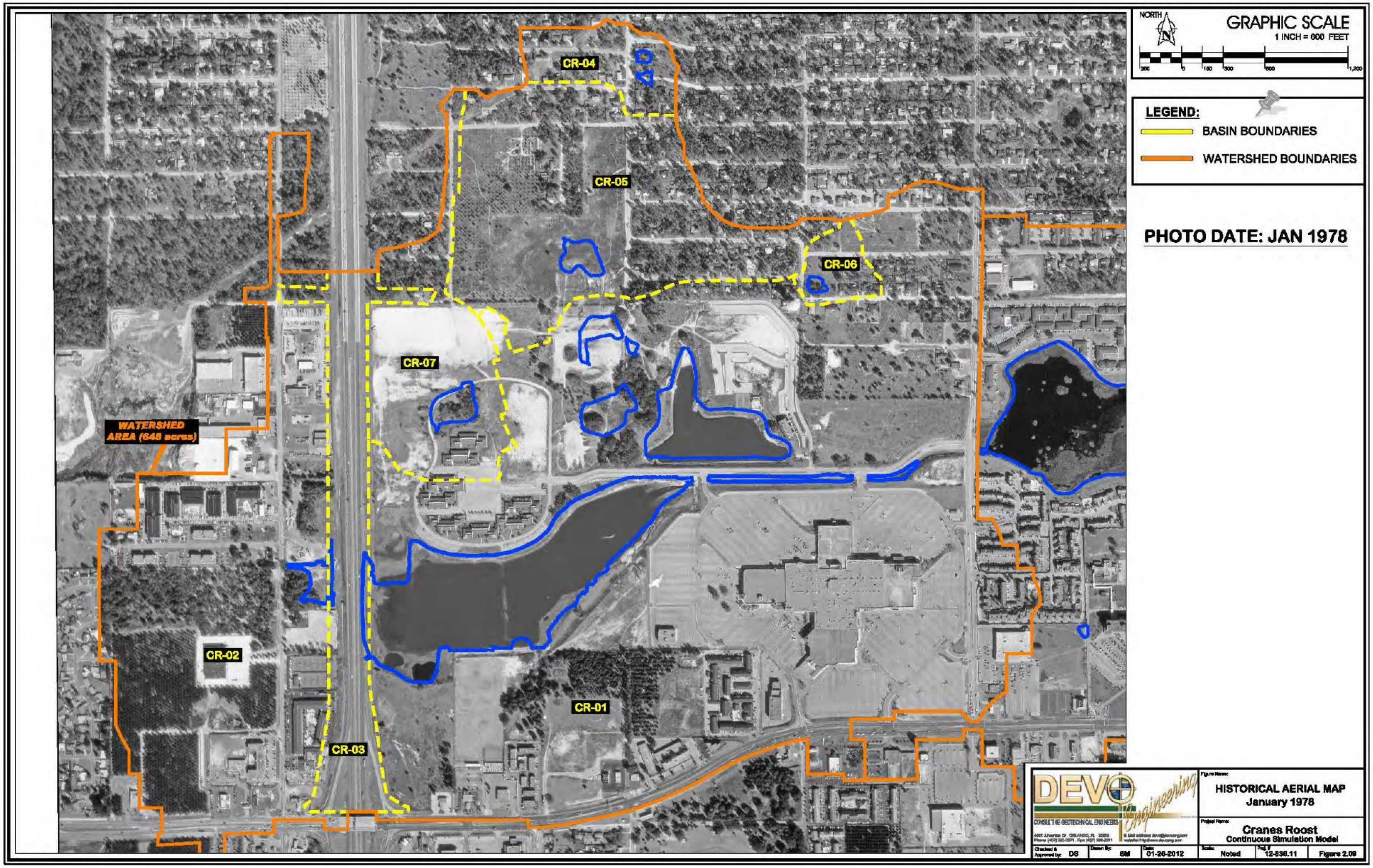
HISTORICAL AERIAL - CRANES ROOST, 1973



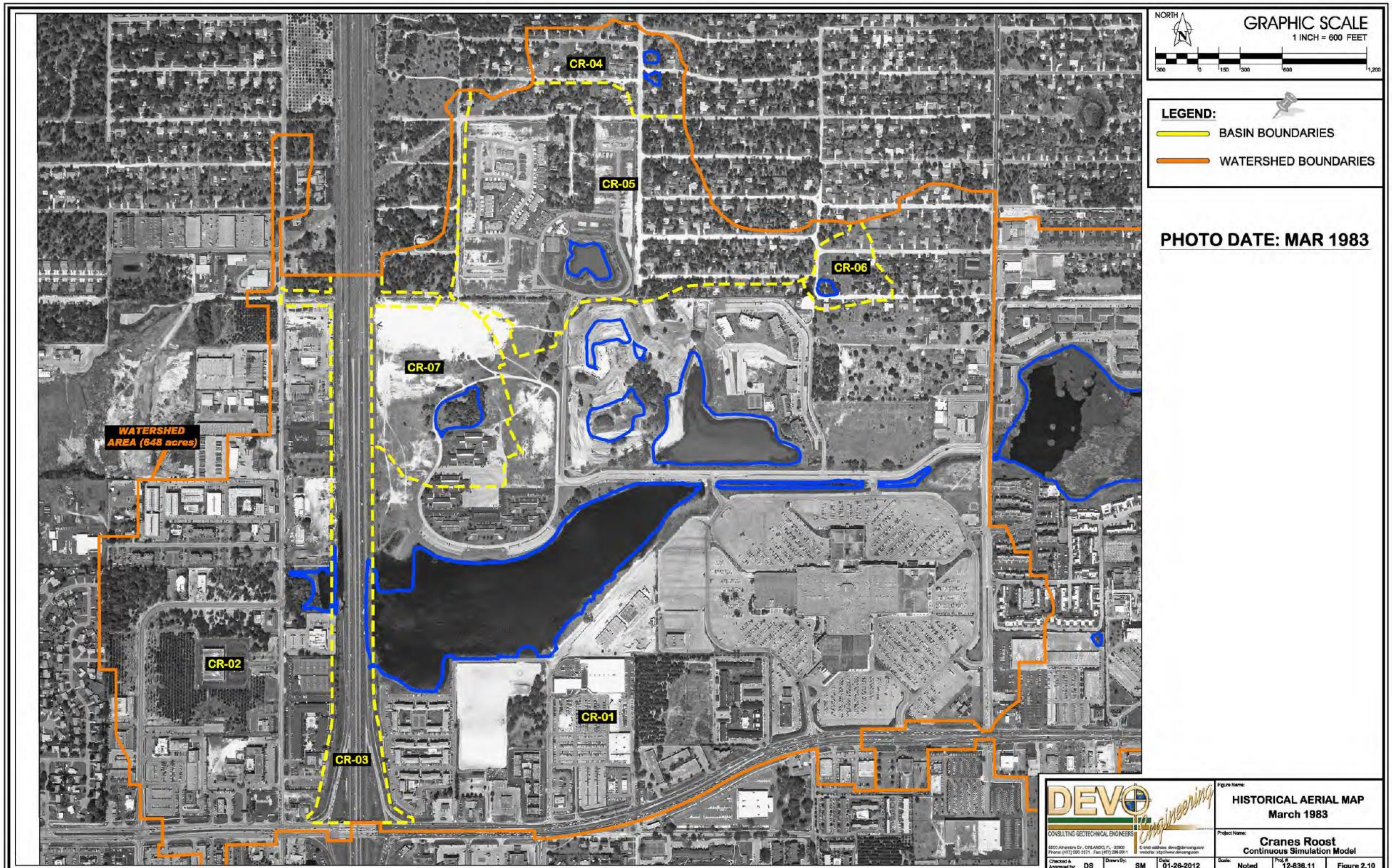
HISTORICAL AERIAL - CRANES ROOST, 1974



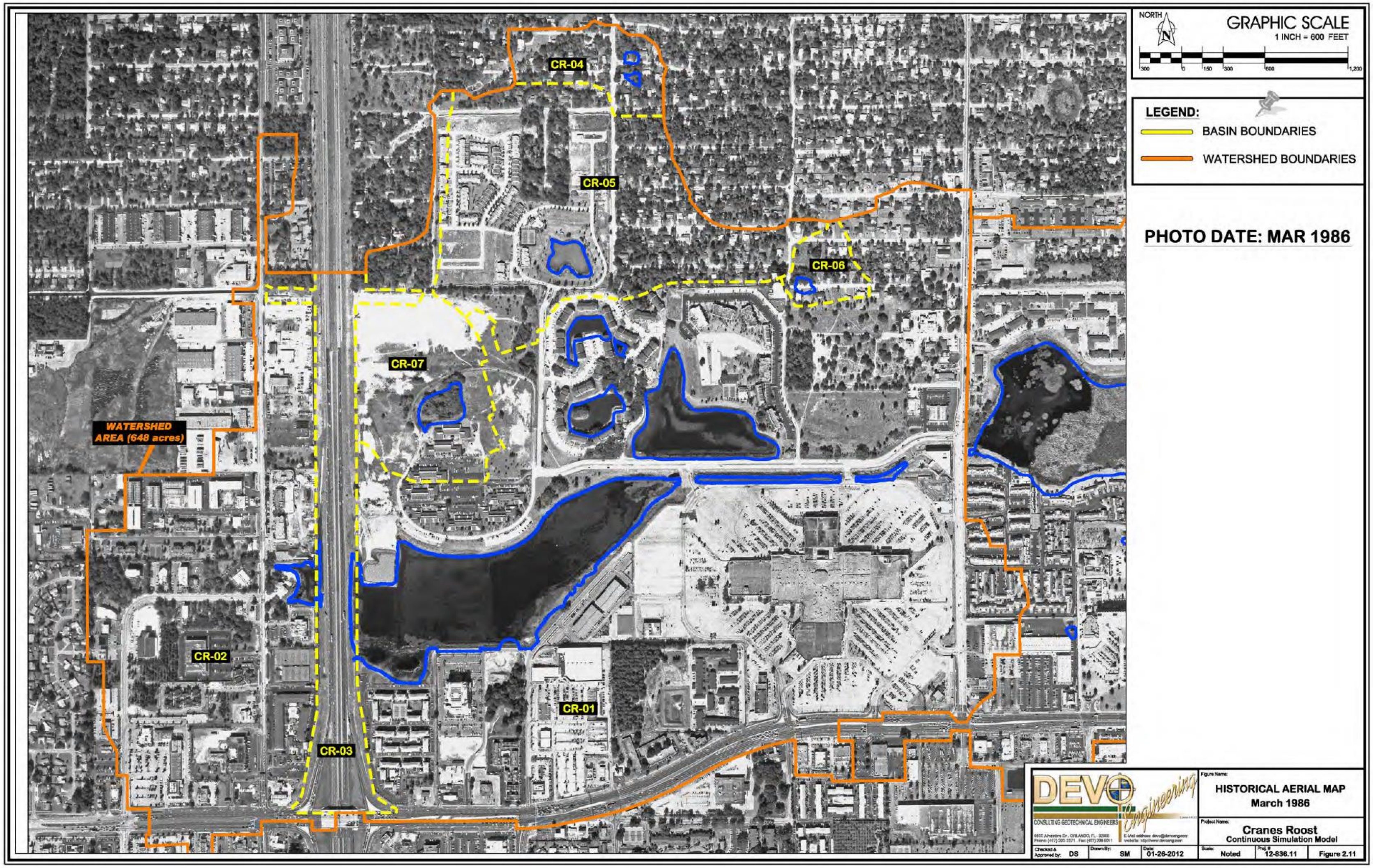
Historical Aerial - Cranes Roost, 1978



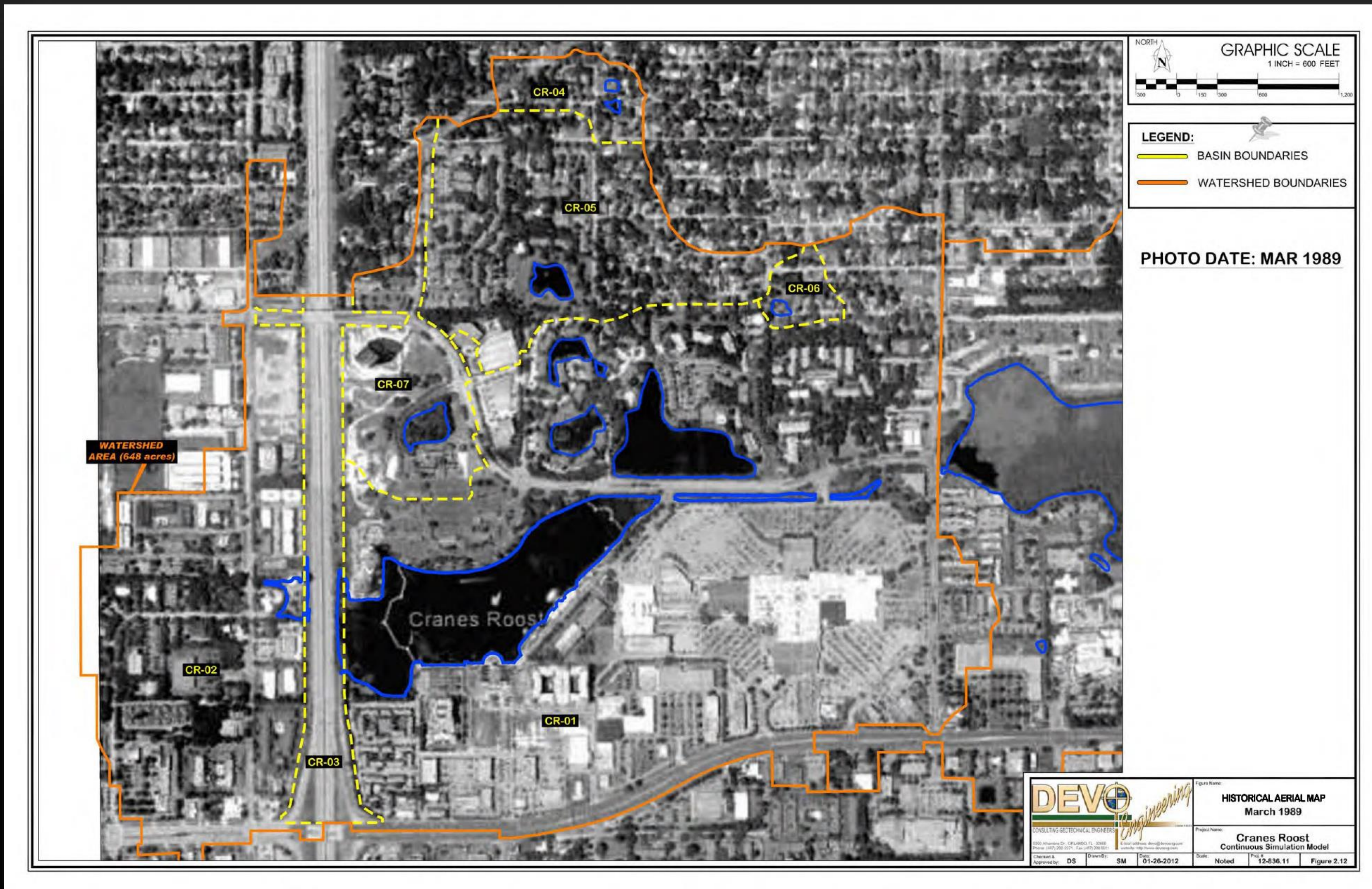
HISTORICAL AERIAL - CRANES ROOST, 1983



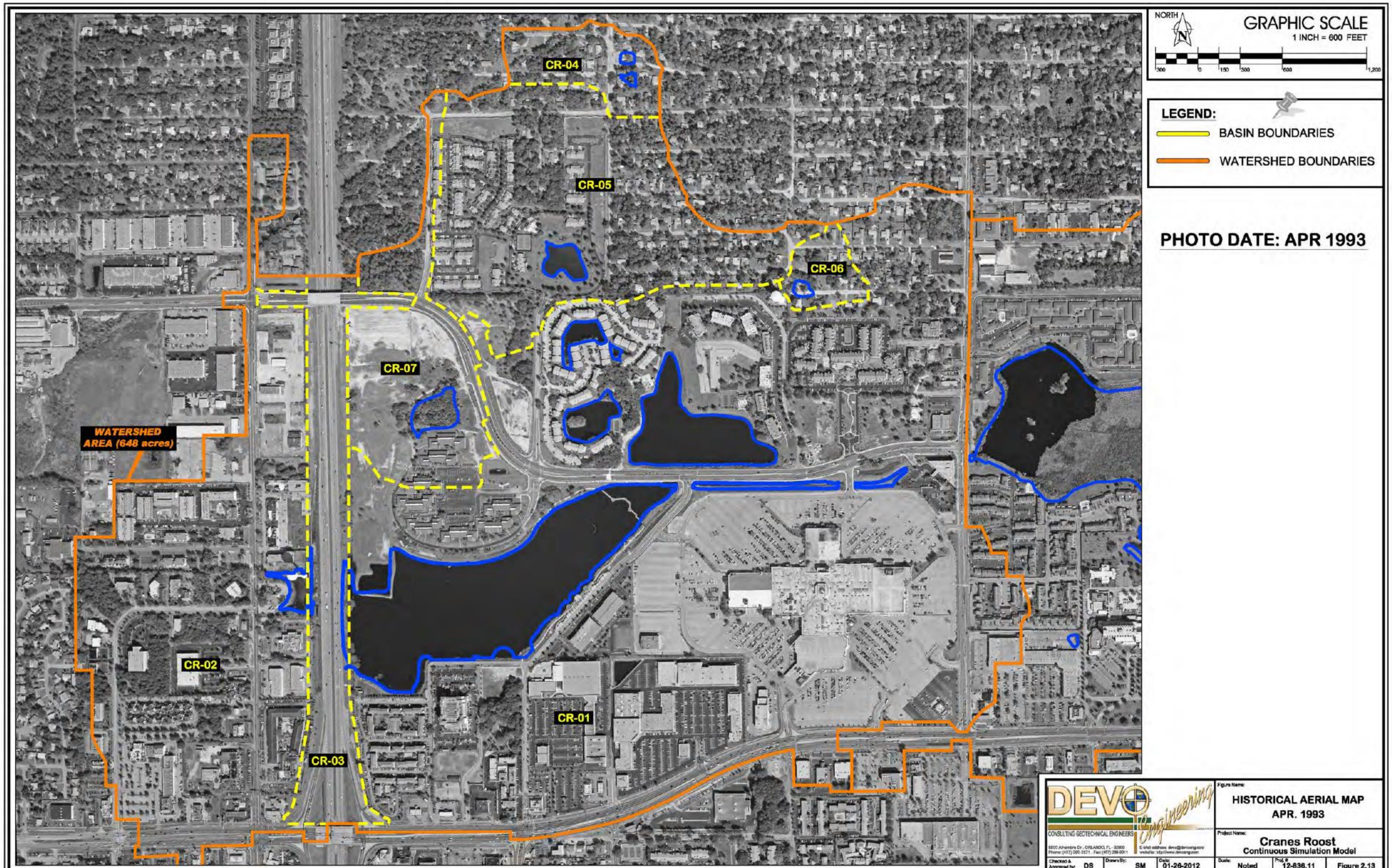
Historical Aerial - Cranes Roost, 1986



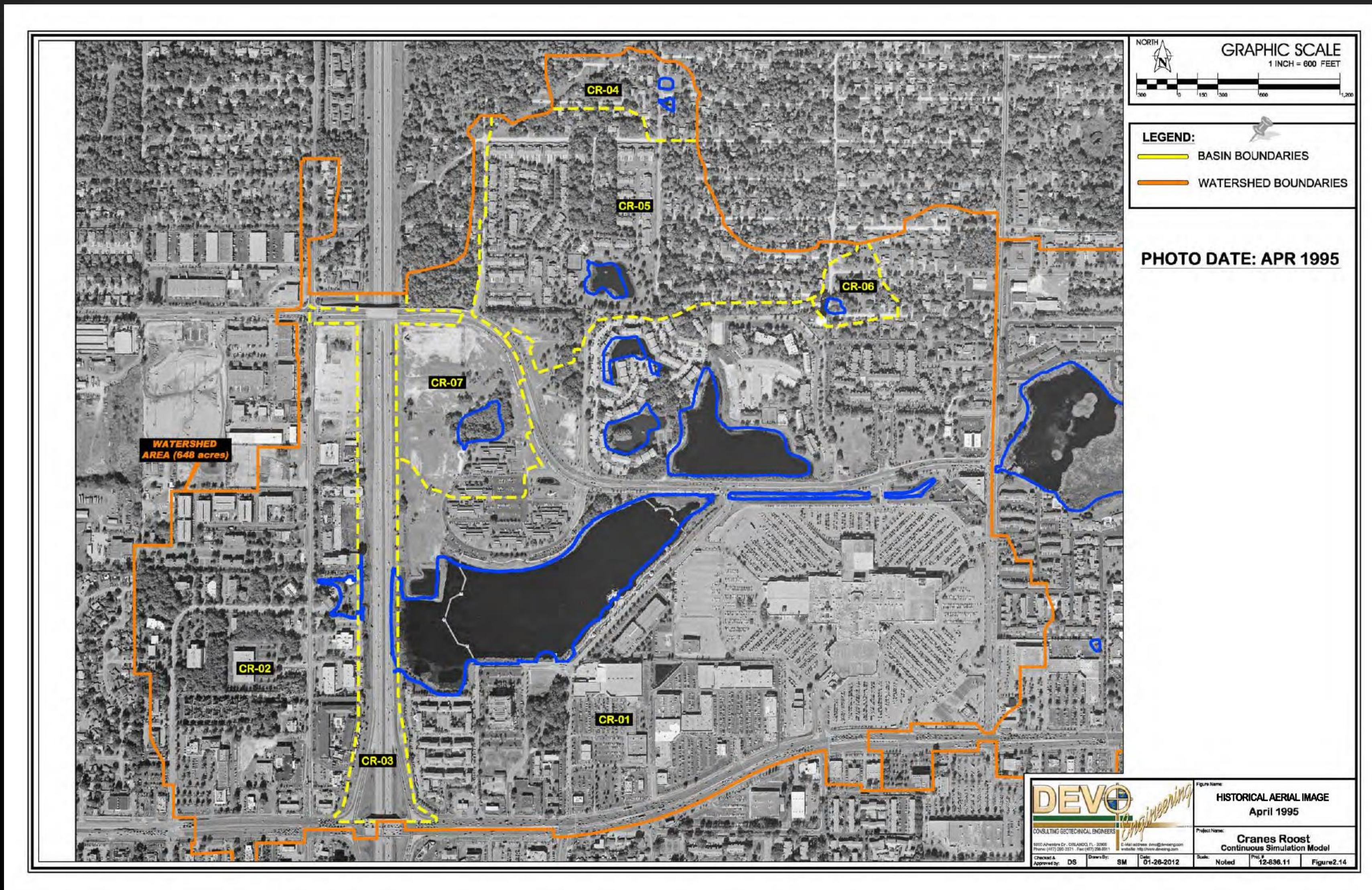
Historical Aerial - Cranes Roost, 1989



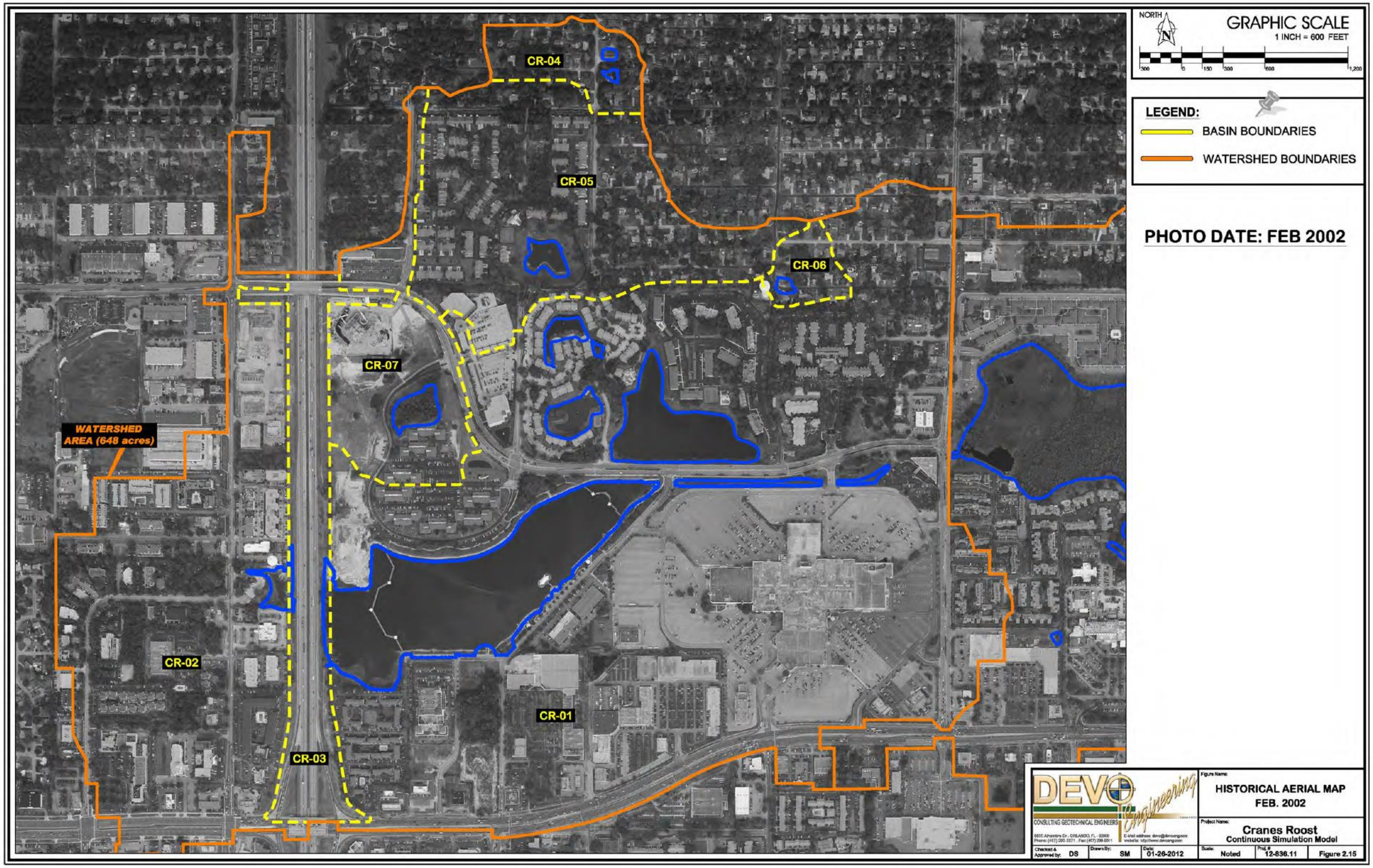
HISTORICAL AERIAL - CRANES ROOST, 1993



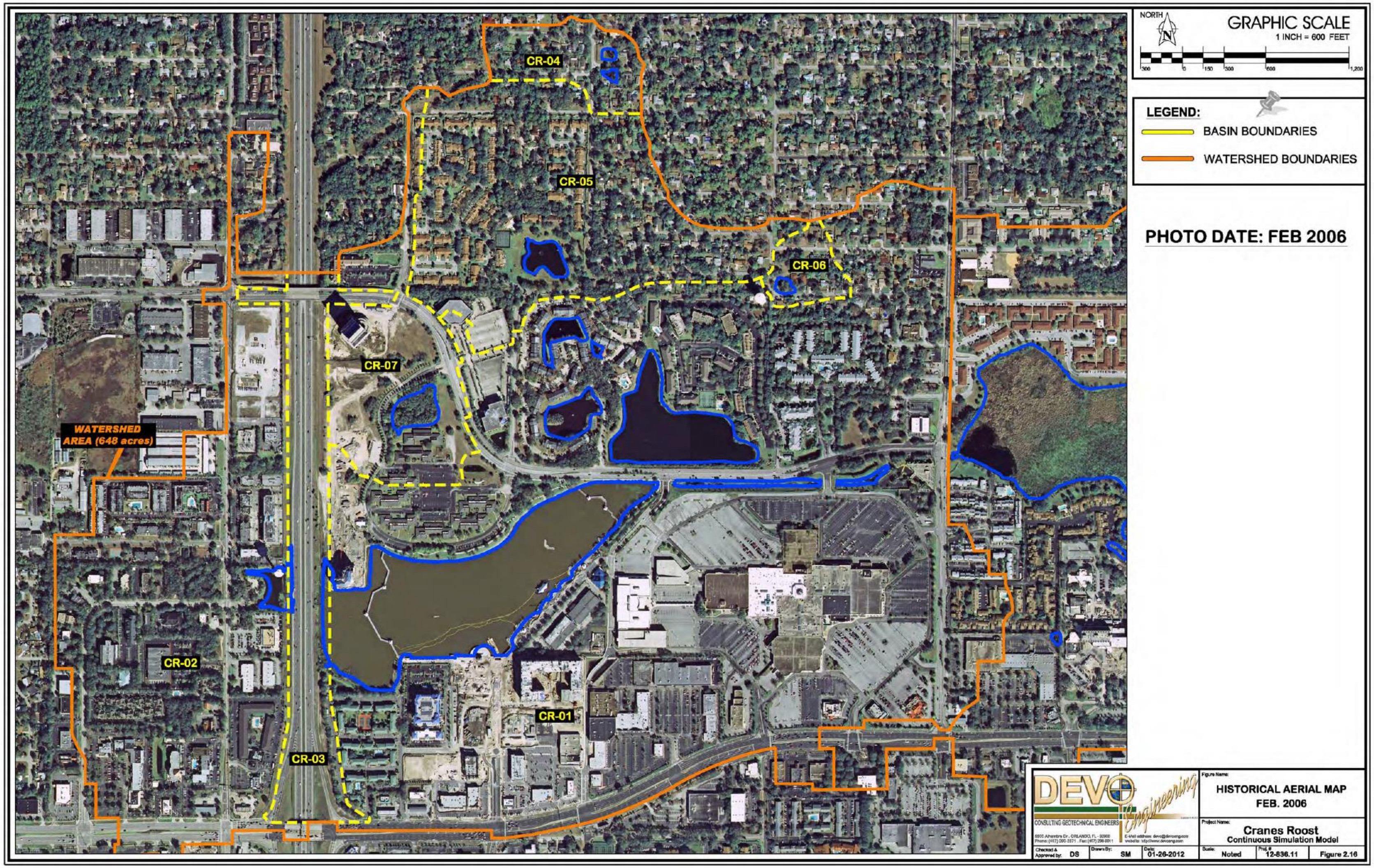
HISTORICAL AERIAL - CRANES ROOST, 1995



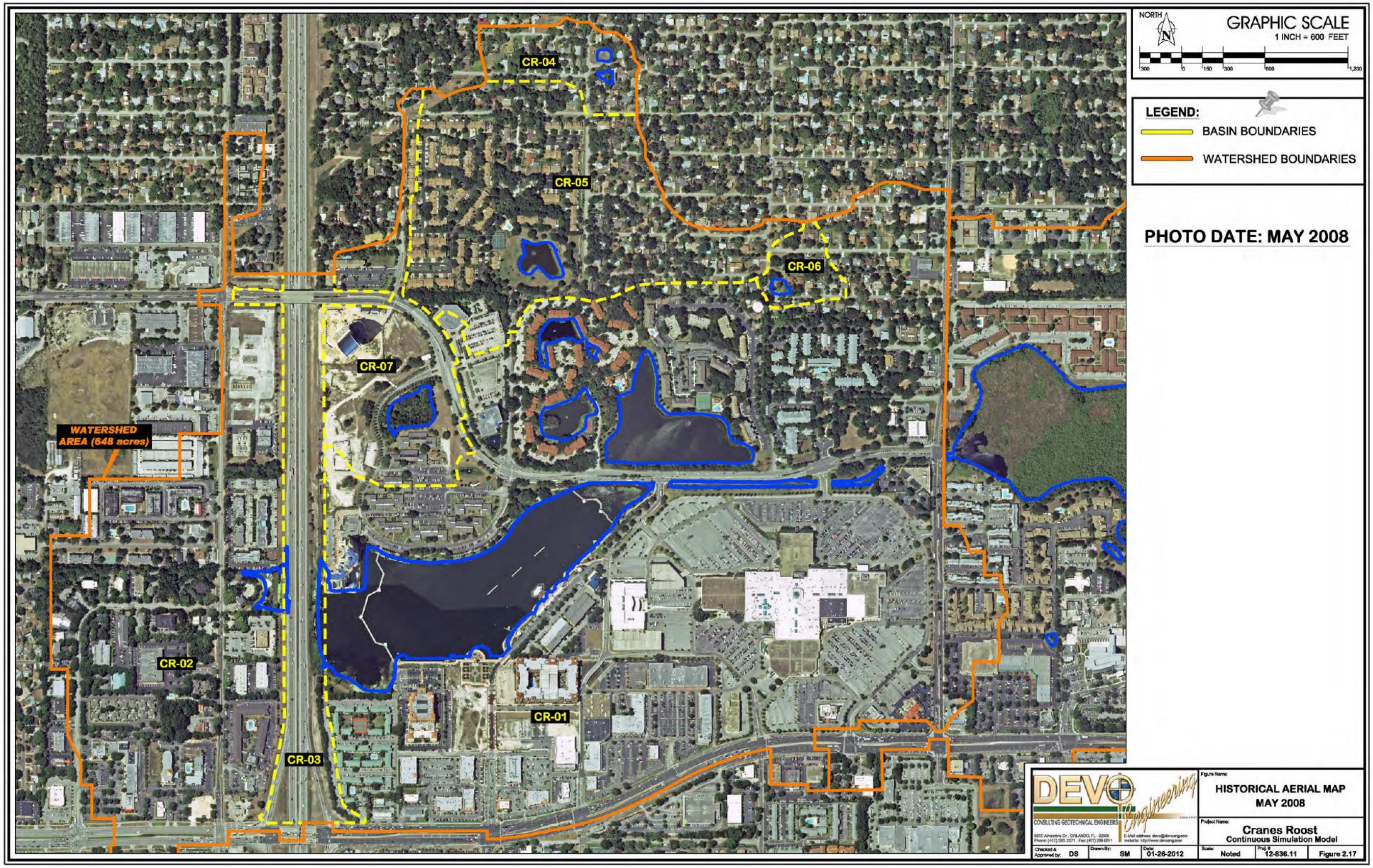
Historical Aerial - Cranes Roost, 2002



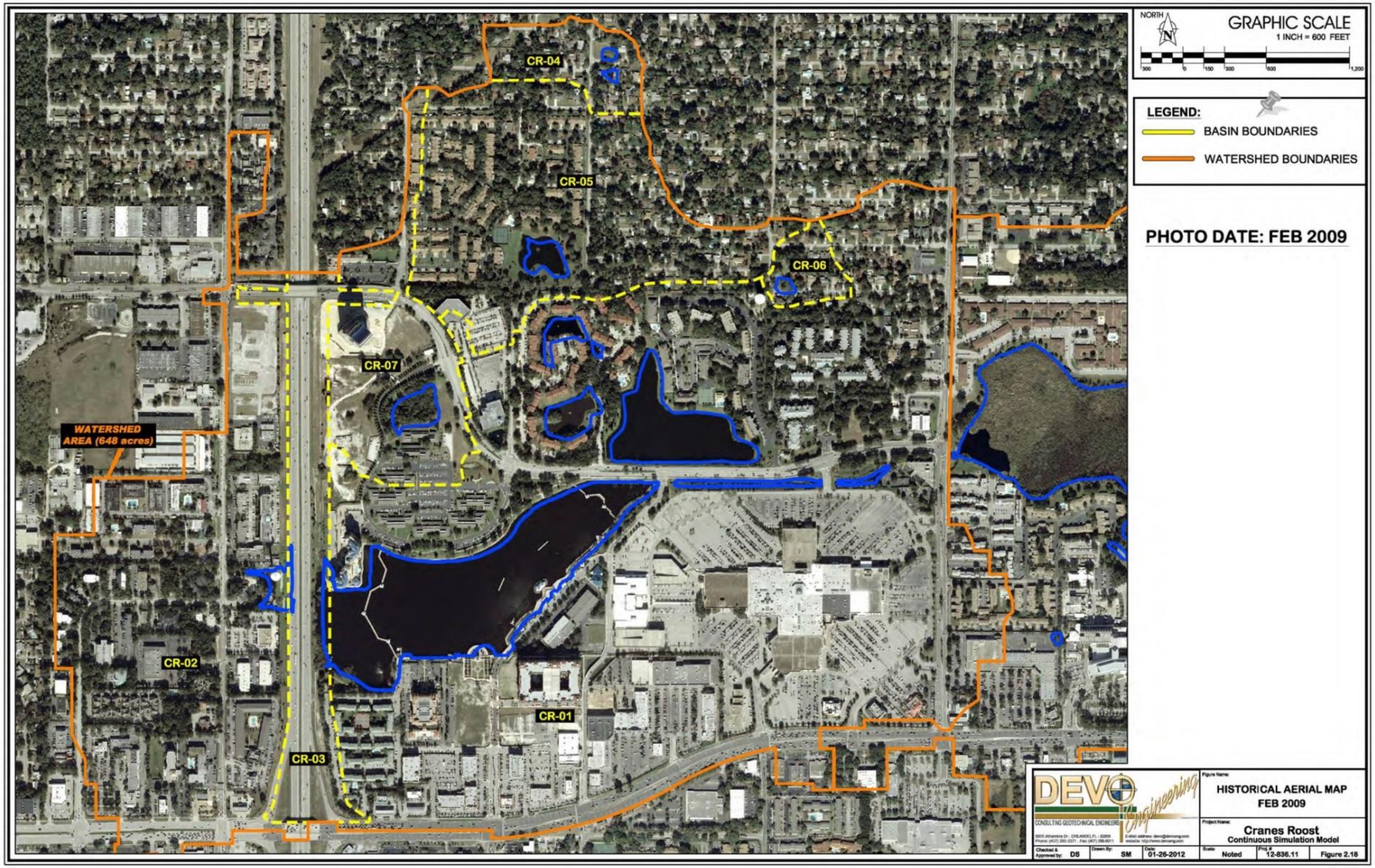
Historical Aerial - Cranes Roost, 2006

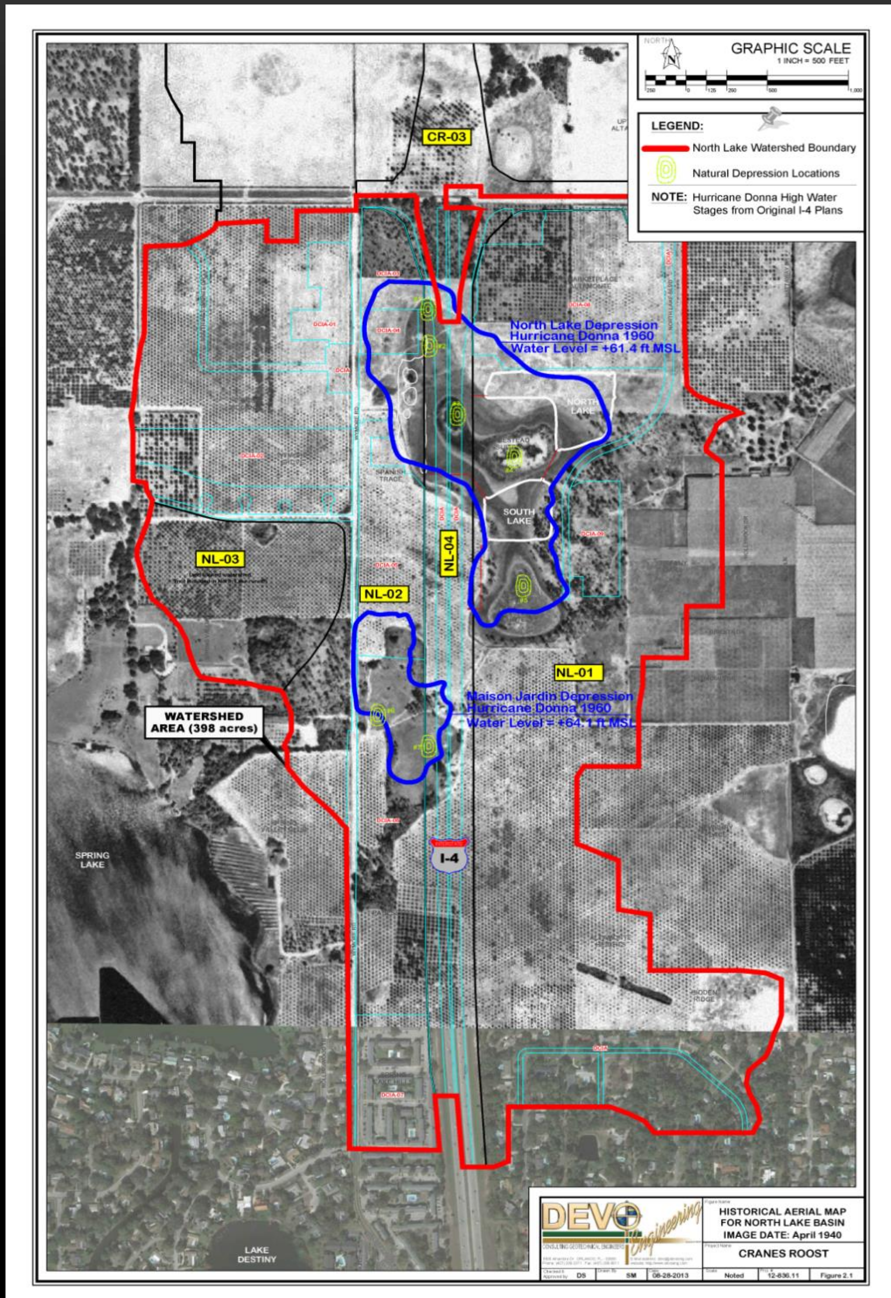


HISTORICAL AERIAL - CRANES ROOST, 2008



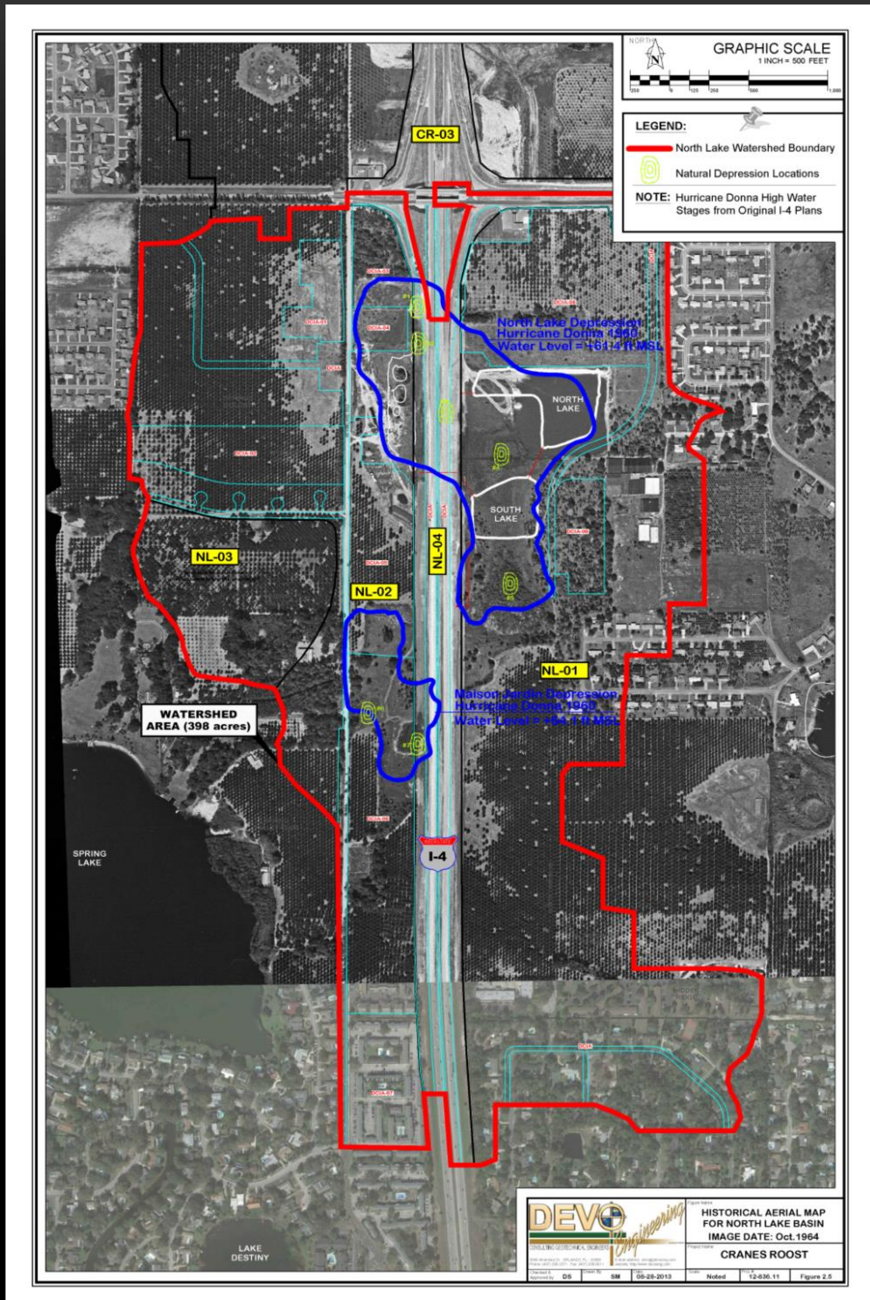
Historical Aerial - Cranes Roost, 2009

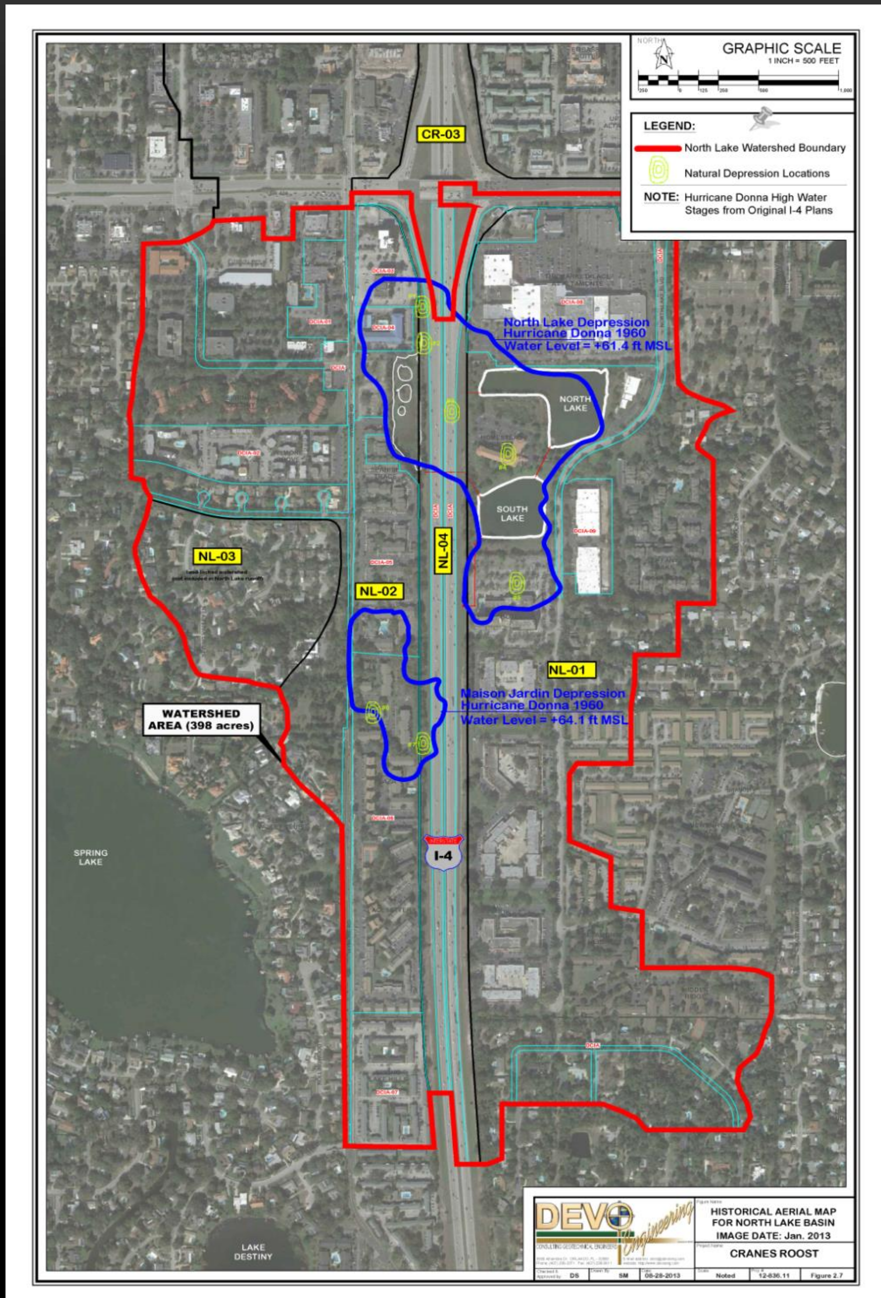




Historical Aerial North Lake, 1940

Historical Aerial North Lake, 1964





Historical Aerial North Lake, 2013

Chronic Flooding of I-4 Right-of-Way Adjacent To North Lake

THE CONCEPT

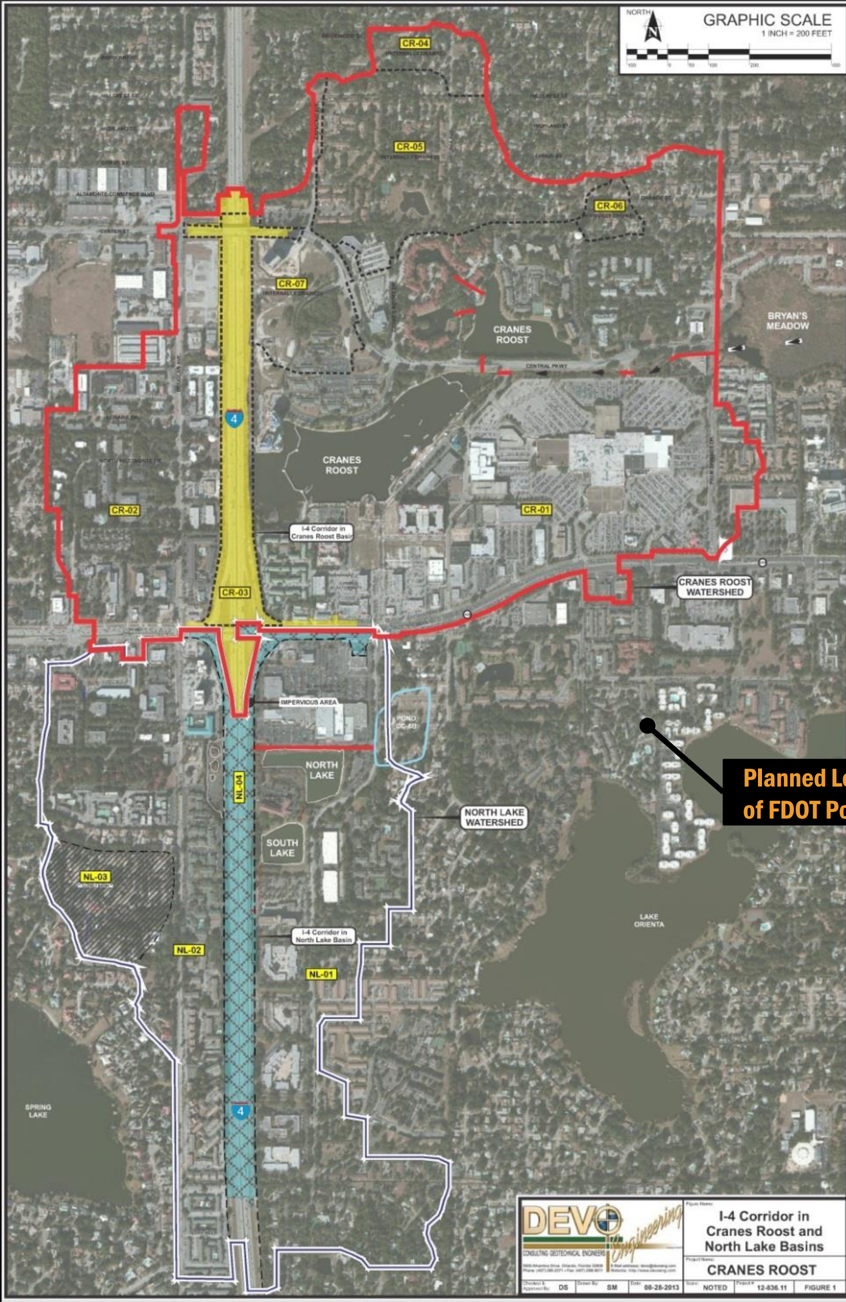
The Concept

- Lower the normal water level in Cranes Roost, by re-permitting pumping elevation thresholds, while retaining existing functions of water body.
  - Stormwater retention
  - Storage for reclaimed water
  - Aesthetic features
- Provide additional stormwater retention for I-4 expansion
- Enhance environmental benefits
  - Reduced discharge to Little Wekiva River
  - Less reliance on supplemental groundwater withdrawals
  - Reduced nutrient discharge
- Allows the City of Altamonte Springs to provide irrigation water to the City of Apopka

THE CONCEPT

- Cranes Roost was previously permitted as an integrated surface water and reclaimed water storage facility for the City of Altamonte Springs (SJRWMD permit issued on May 4, 2012).
- Planned widening of I-4 through Altamonte Springs required that additional stormwater treatment be provided. FDOT originally planned to build a separate, above ground retention pond in an adjacent basin.
- Cooperation between the City, Apopka, FDOT and SJRWMD, enabled re-permitting of Cranes Roost to accommodate the additional runoff from I-4, as well as considering the City's infrastructure needs.
- Thus leading to the creation of the A-FIRST Project: **A**ltamonte Springs – **F**DOT **I**ntegrated **R**euse & **S**tormwater **T**reatment

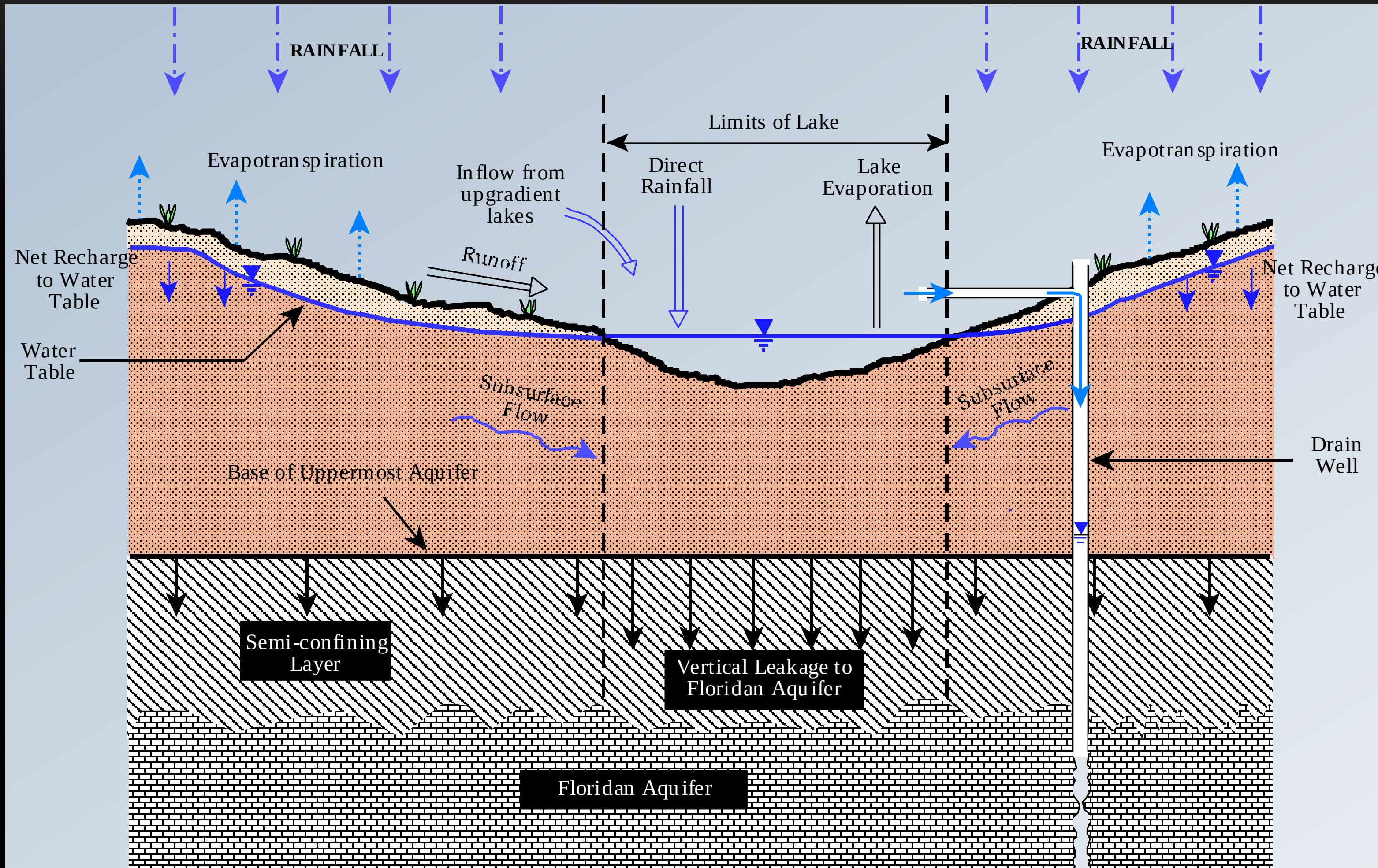
North Lake Watershed & I-4 Corridor



Continuous Simulation Modeling

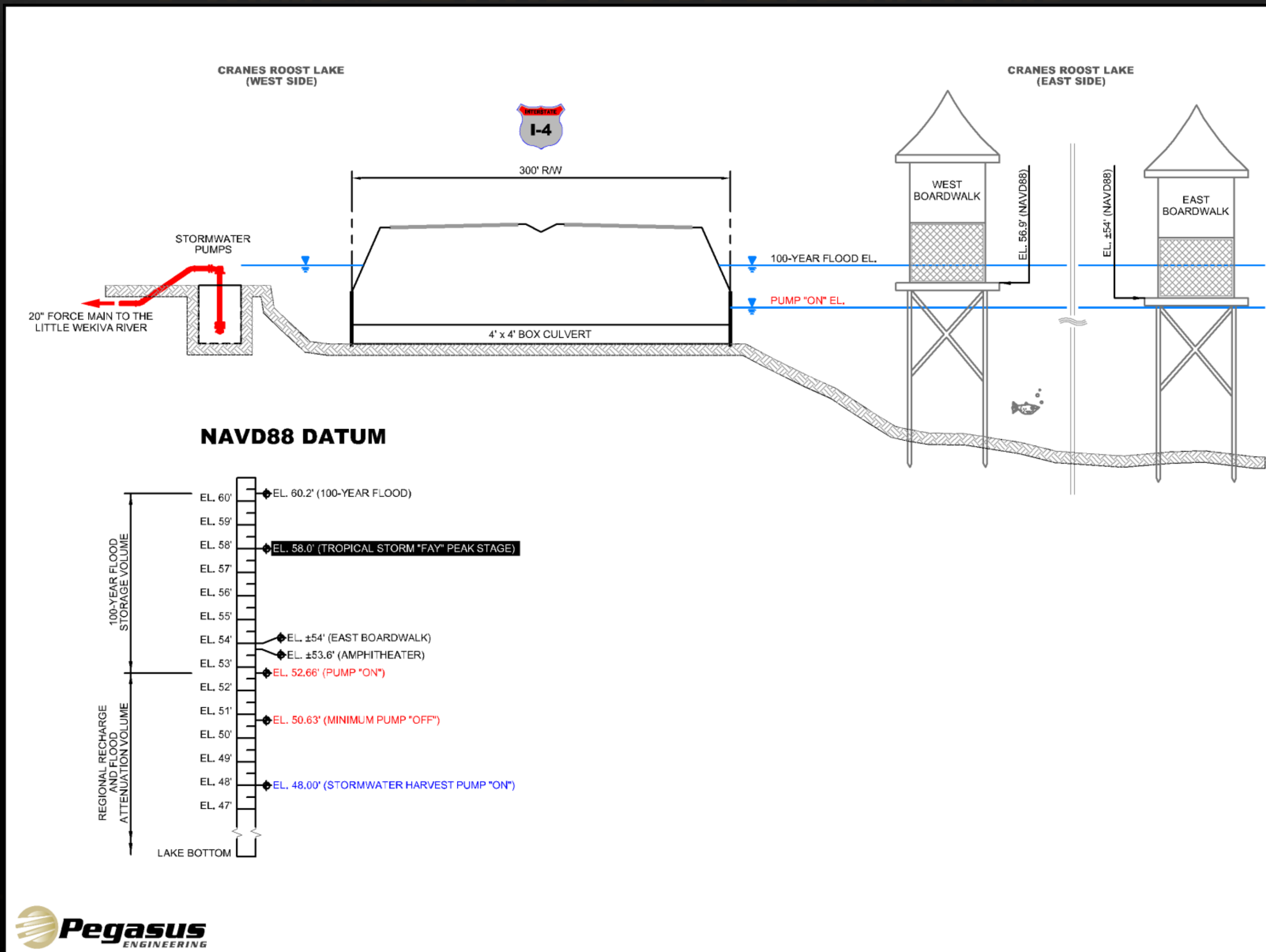
- Continuous simulation modeling based on 21 years or rainfall data and lake level/Floridan aquifer observations for Cranes Roost (1991 to 2011 at 15 minute increments)
- Modeled using the PONDS 3.3 Refined Method software, with features added specifically for this project
- Multi-basin, interconnected lake water bodies connected to Floridan aquifer

Conceptual Model



THE TECHNOLOGY

Crane's Roost Key Elevations



Modeled Pumping Configuration

Pumping Schematic For Proposed Conditions

PUMP 1 - RECLAIMED WATER INFLOW INTO CRANES ROOST
1. Pump 1 can be activated when water level in Cranes Roost is below +48 ft NAVD, and
2. Pump 1 can be activated if Antecedent Moisture Condition (AMC) is AMC II or AMC III.
3. Reuse water is pumped in at a rate of 4 MGD (only if reclaimed water is available from City plant).

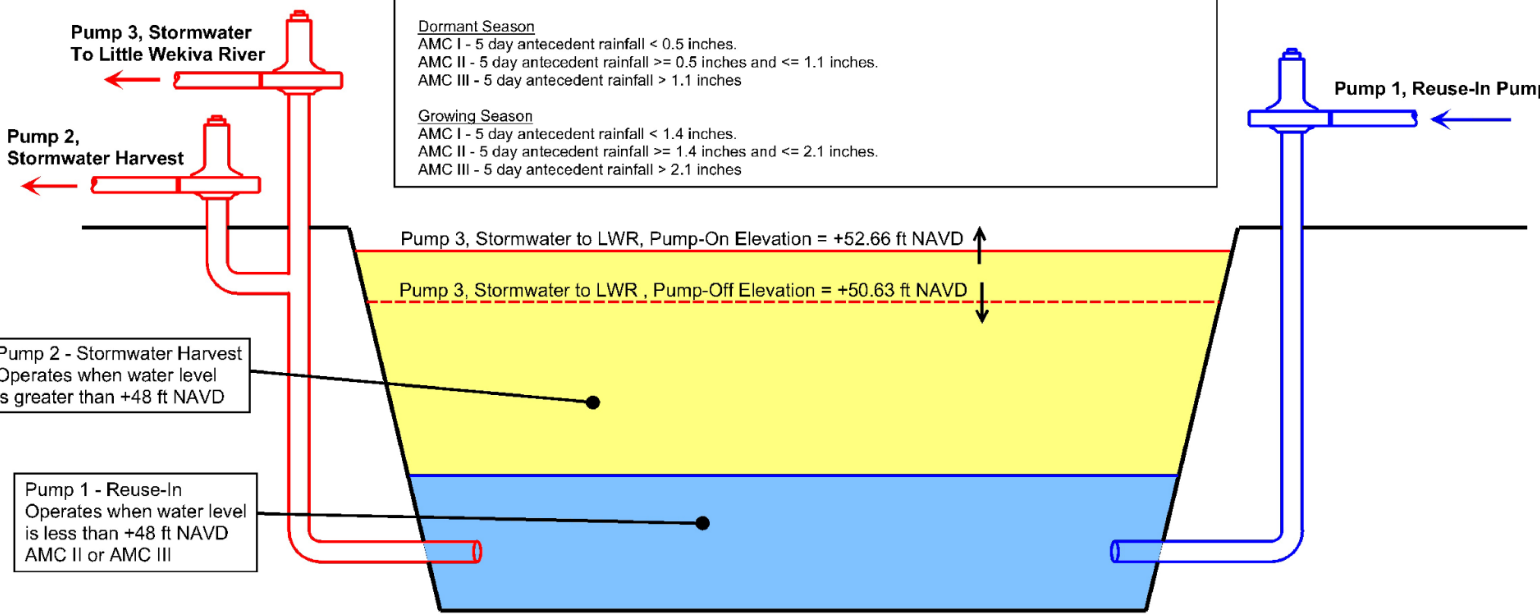
PUMP 2 - STORMWATER HARVESTING
1. Stormwater harvesting occurs if the water level in Cranes Roost is greater than +48.0 ft NAVD.
2. Pumping occurs at a rate of 3 MGD (2,083 gpm).
3. Pumping is independent of Antecedent Moisture Condition.

PUMP 3 - STORMWATER PUMP OUTFALL TO LITTLE WEKIVA RIVER
1. Stormwater pumping to Little Wekiva River operates when water level exceeds +52.66 ft NAVD (by permit)
2. Stormwater pumping to Little Wekiva River stops when water level drops below +50.63 ft NAVD (by permit).
3. Water is pumped to Little Wekiva River at a rate of 10.8 MGD (7,500 gpm).
4. Maximum pumping threshold (by permit) is 11.5 MGD.

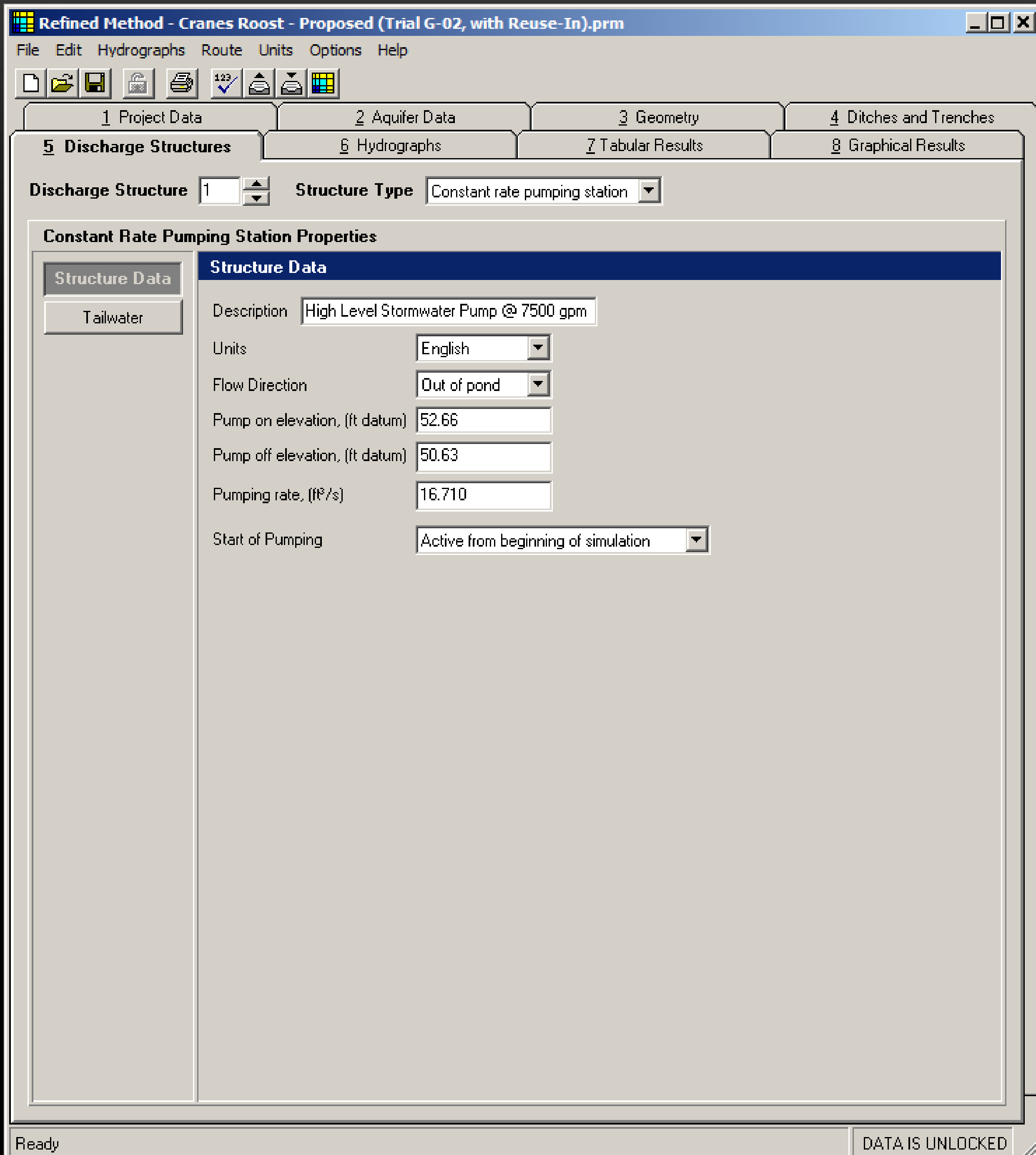
Note: The Antecedent Moisture Condition (AMC) is based on the previous 5-day rainfall total, as follows:

Dormant Season
AMC I - 5 day antecedent rainfall < 0.5 inches.
AMC II - 5 day antecedent rainfall >= 0.5 inches and <= 1.1 inches.
AMC III - 5 day antecedent rainfall > 1.1 inches

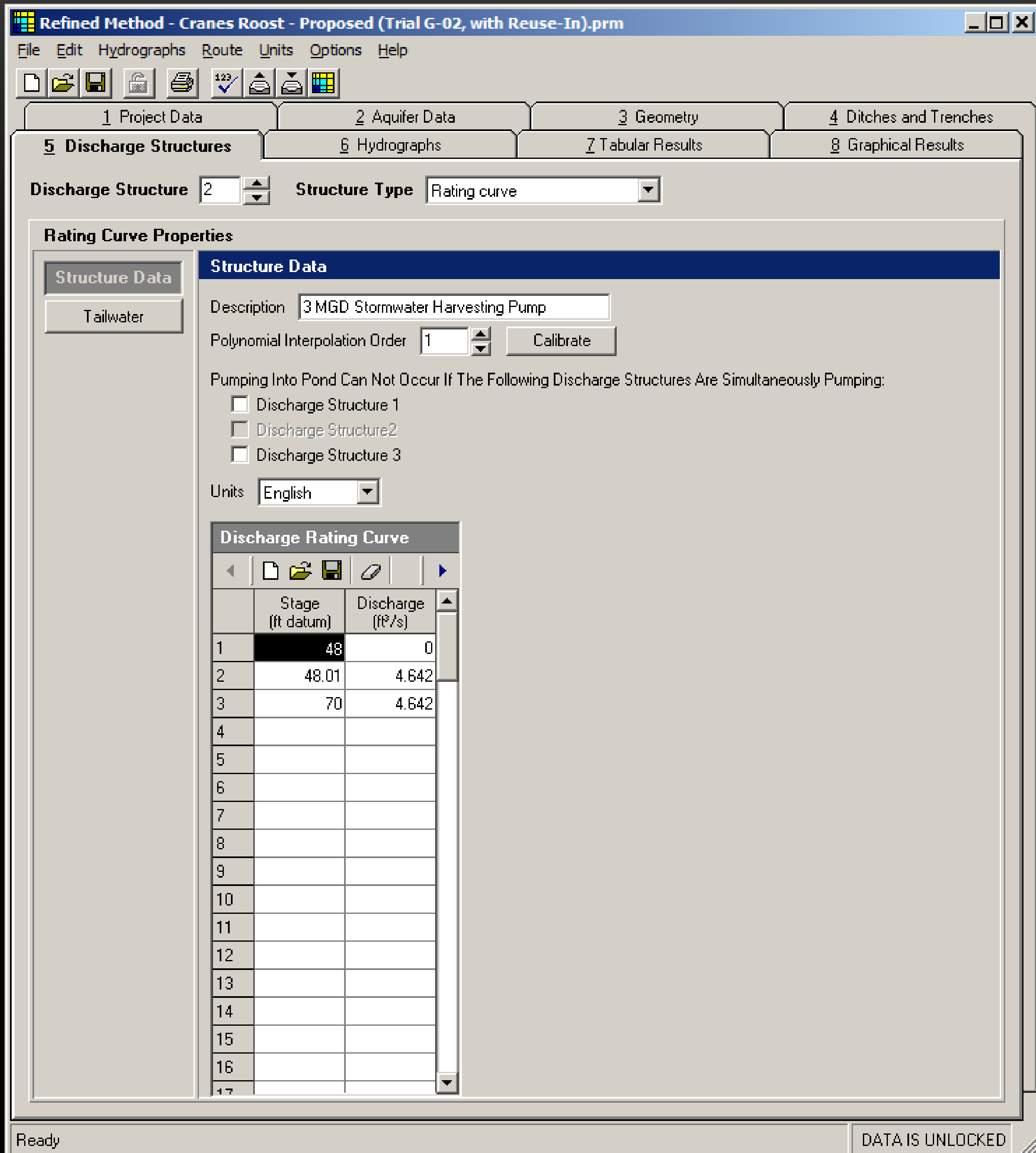
Growing Season
AMC I - 5 day antecedent rainfall < 1.4 inches.
AMC II - 5 day antecedent rainfall >= 1.4 inches and <= 2.1 inches.
AMC III - 5 day antecedent rainfall > 2.1 inches

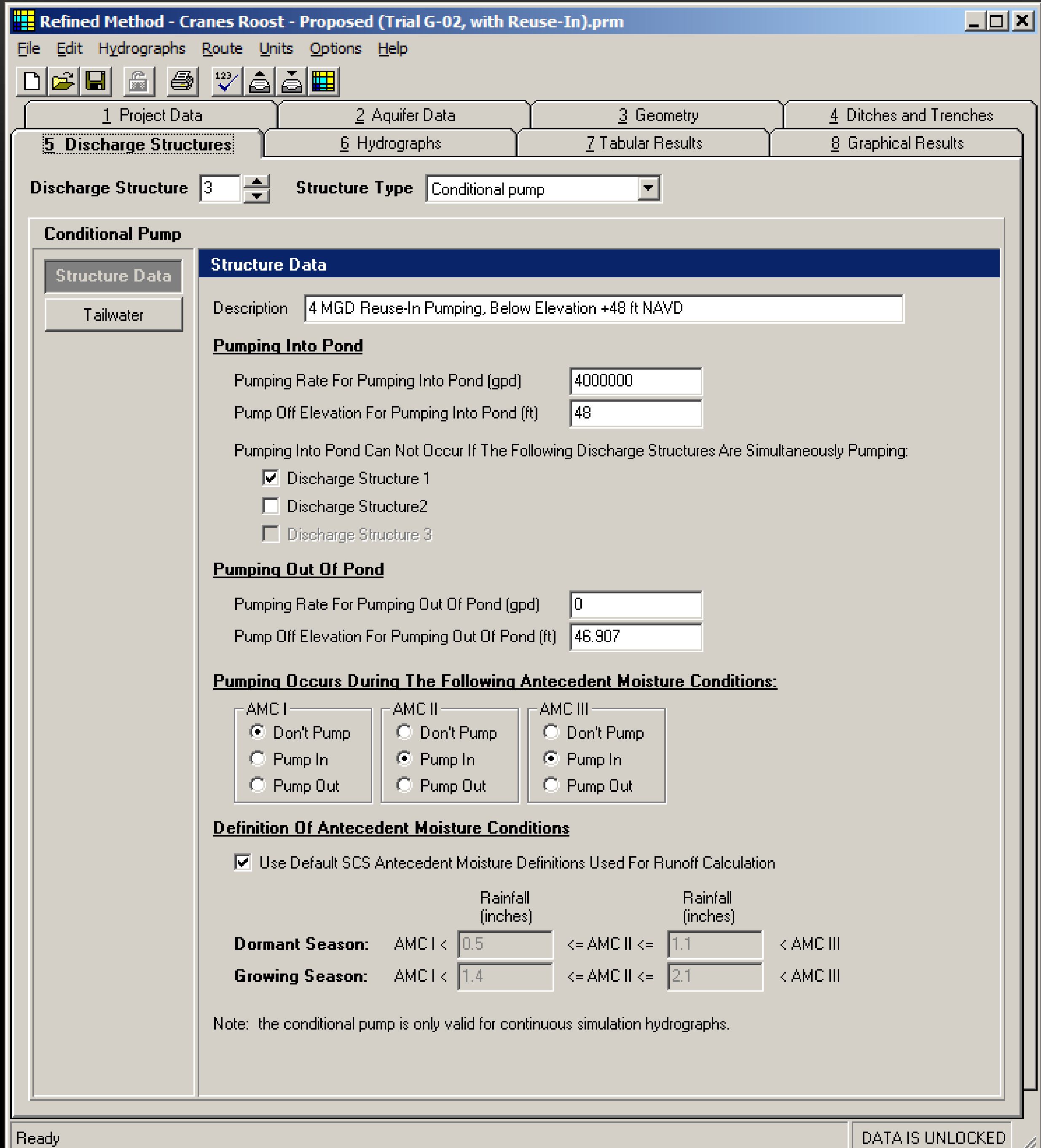


High Level Stormwater Pump

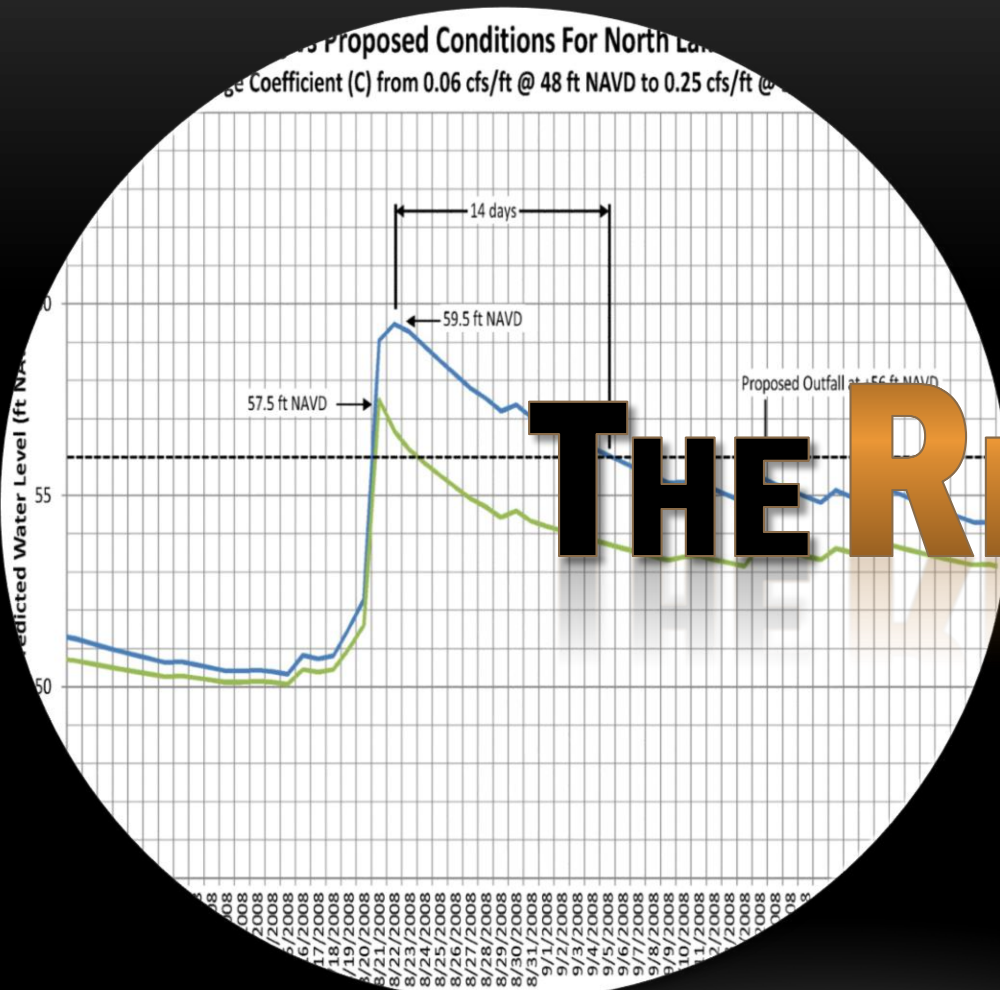


Stormwater Harvesting Pump, (Rating Curve)





Reuse In: New Discharge Structure Type In Ponds 3.3



The Results

ROUND NUMBERS ONLY, BACK OF THE ENVELOPE HAND CALC

CRANES ROOST AS A PUMPED & RECONFIGURED BATHTUB DURING TS FAY

Storm event = TS Fay, 12.89 inches of rainfall in 6 days (Aug 18 to 23, 2008)

- ***NEGATIVES***

  -Loss of storage volume in Cranes Roost from geometric contraction due to I-4 = -16.7 ac-ft

  -North Lake transfer & I 4 Related additional runoff TS Fay = -97 ac-ft

  1 -28.3 ac-ft from North Lake

  2 -59.7 ac-ft Additional I-4 Runoff

  3 -9.1 ac-ft additional discharge from Lake Adelaide

  TOTAL INCREASE IN STORMWATER RUNOFF = -97 ac-ft total

- ***POSITIVES***

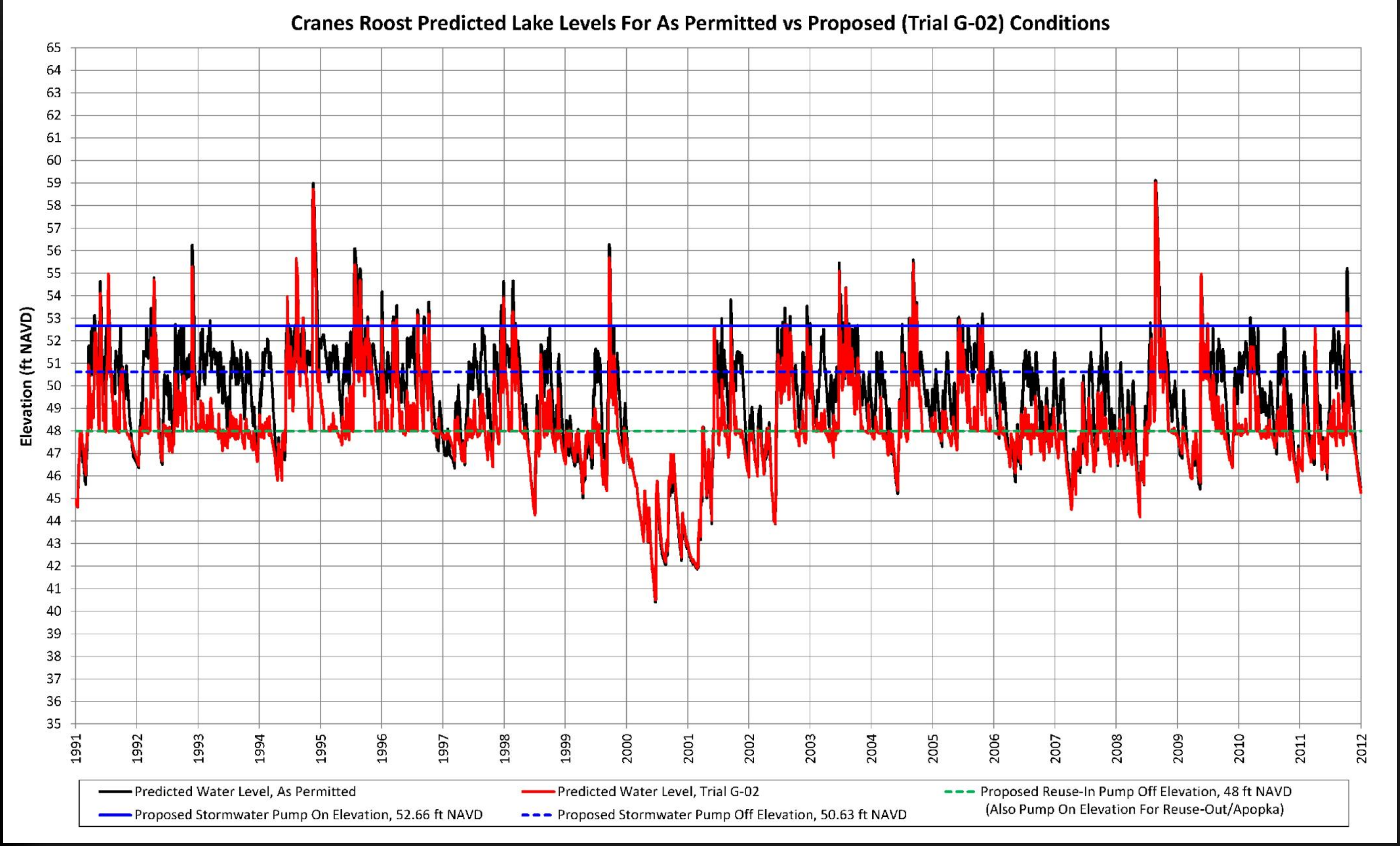
  -Initial stage credit of 1.5 ft at start of storm (49.0 vs 50.5) = +72 ac-ft

  -Pumped Discharge (Harvest) During Storm = 3,000,000 gpd (400,000 cubic feet per day) × 6 days duration of TS Fay = +55 ac-ft

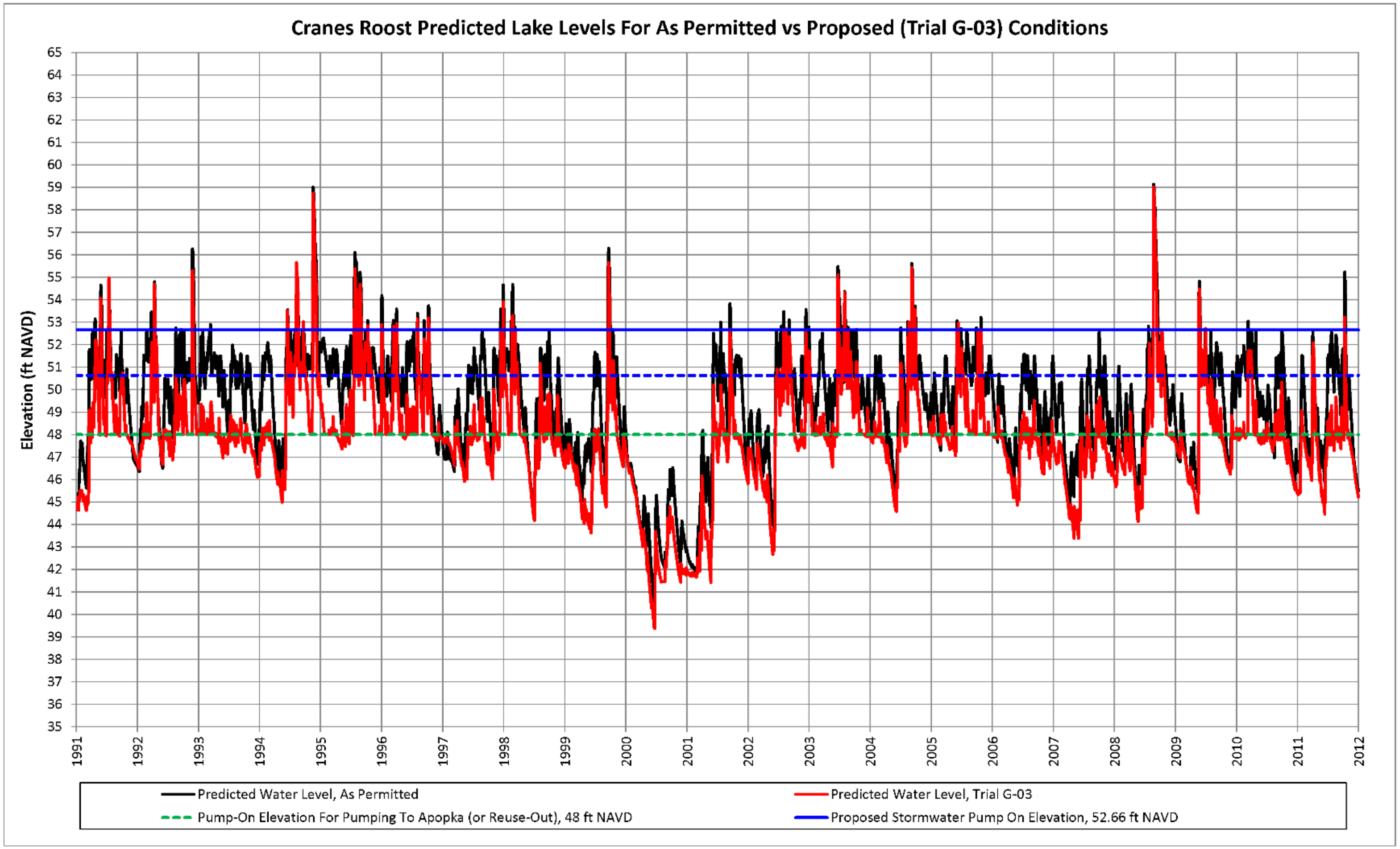
- ***NET GAIN IN STORAGE DURING TS FAY***

Net Volume = -16.7 + 72 + 55 - 97 = +13.3 ac-ft, which translates into a maximum betterment of 0.2 ft in stage

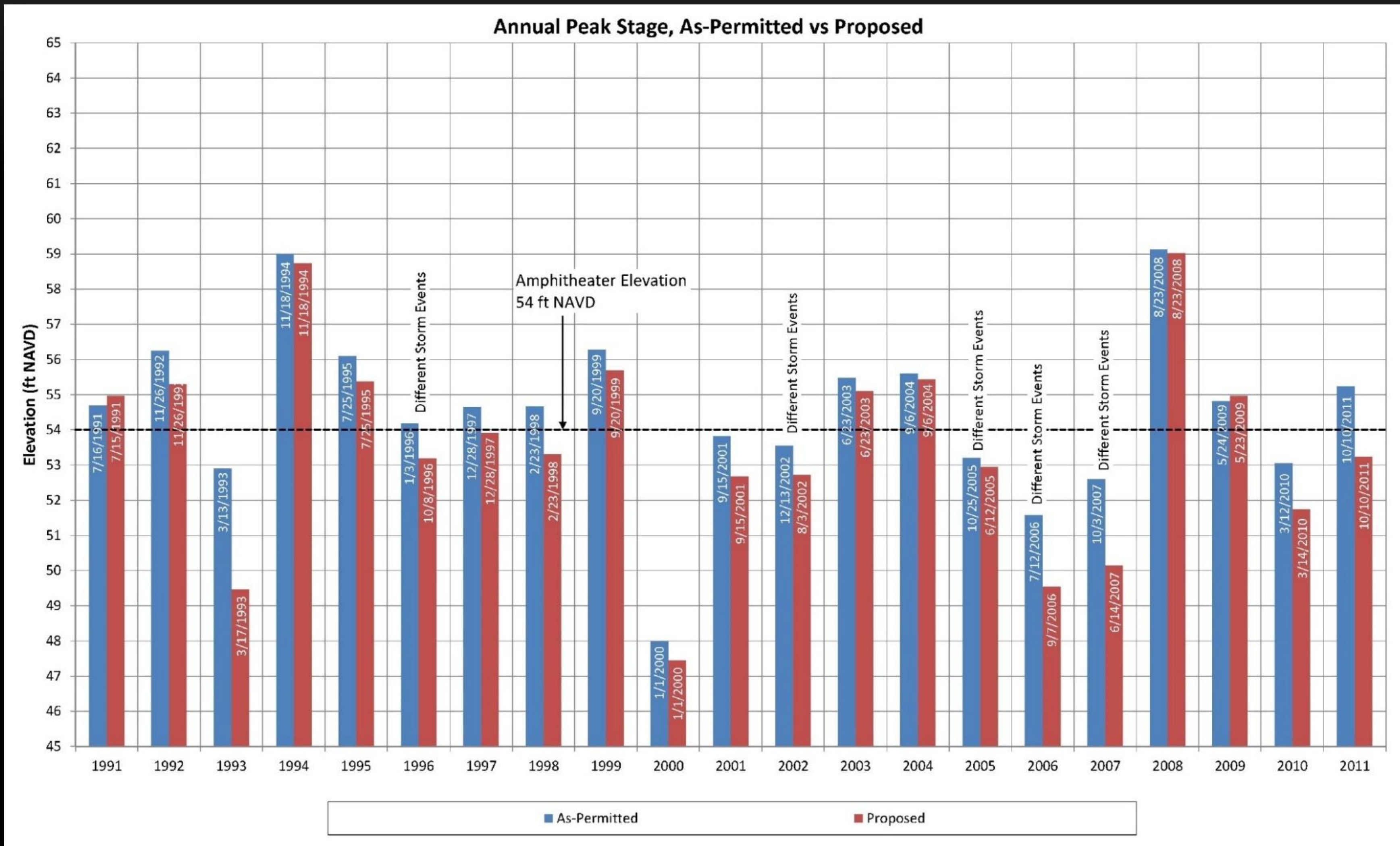
EXISTING VS PROPOSED HYDROPERIOD



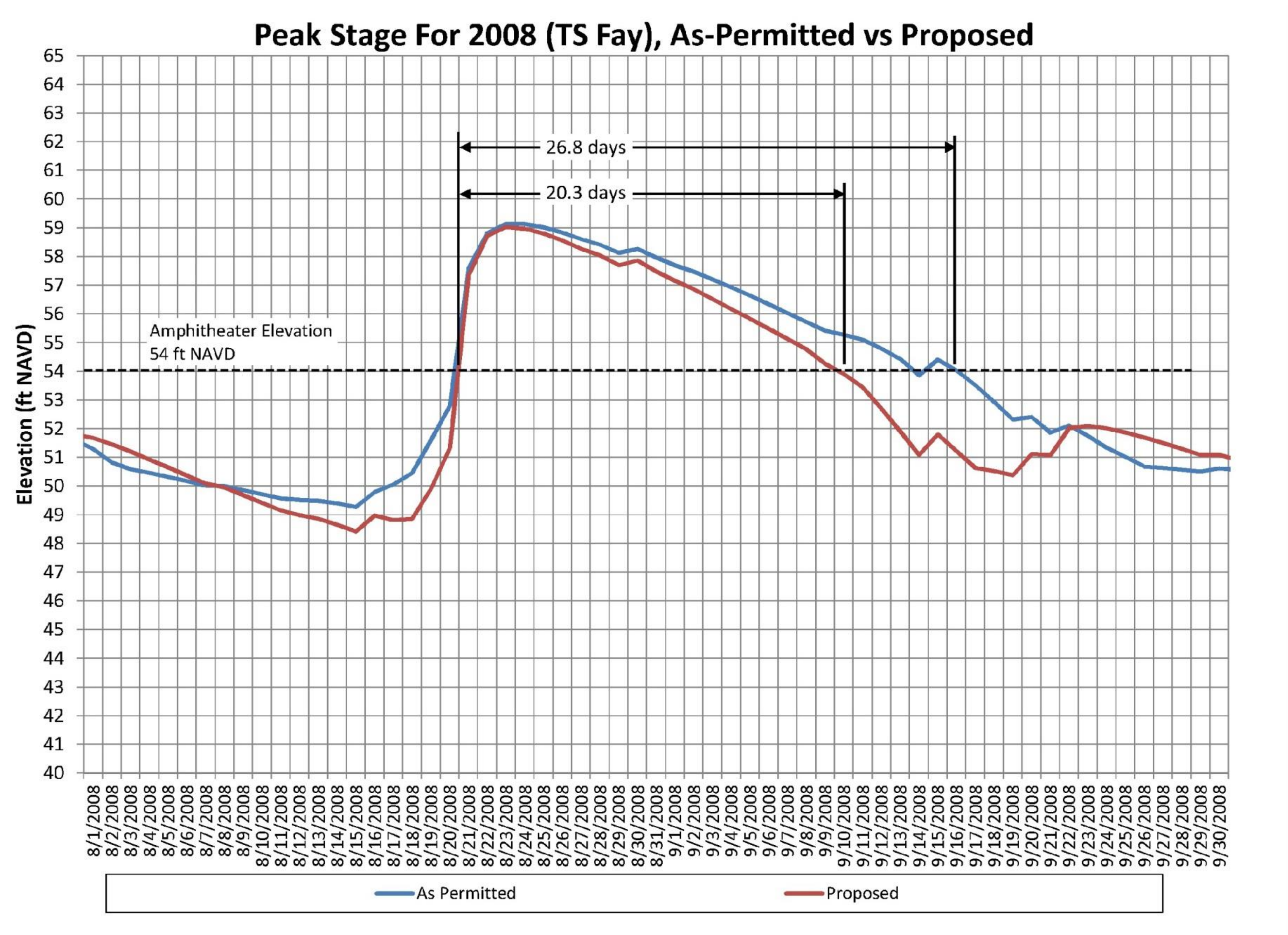
EXISTING VS PROPOSED HYDROPERIOD



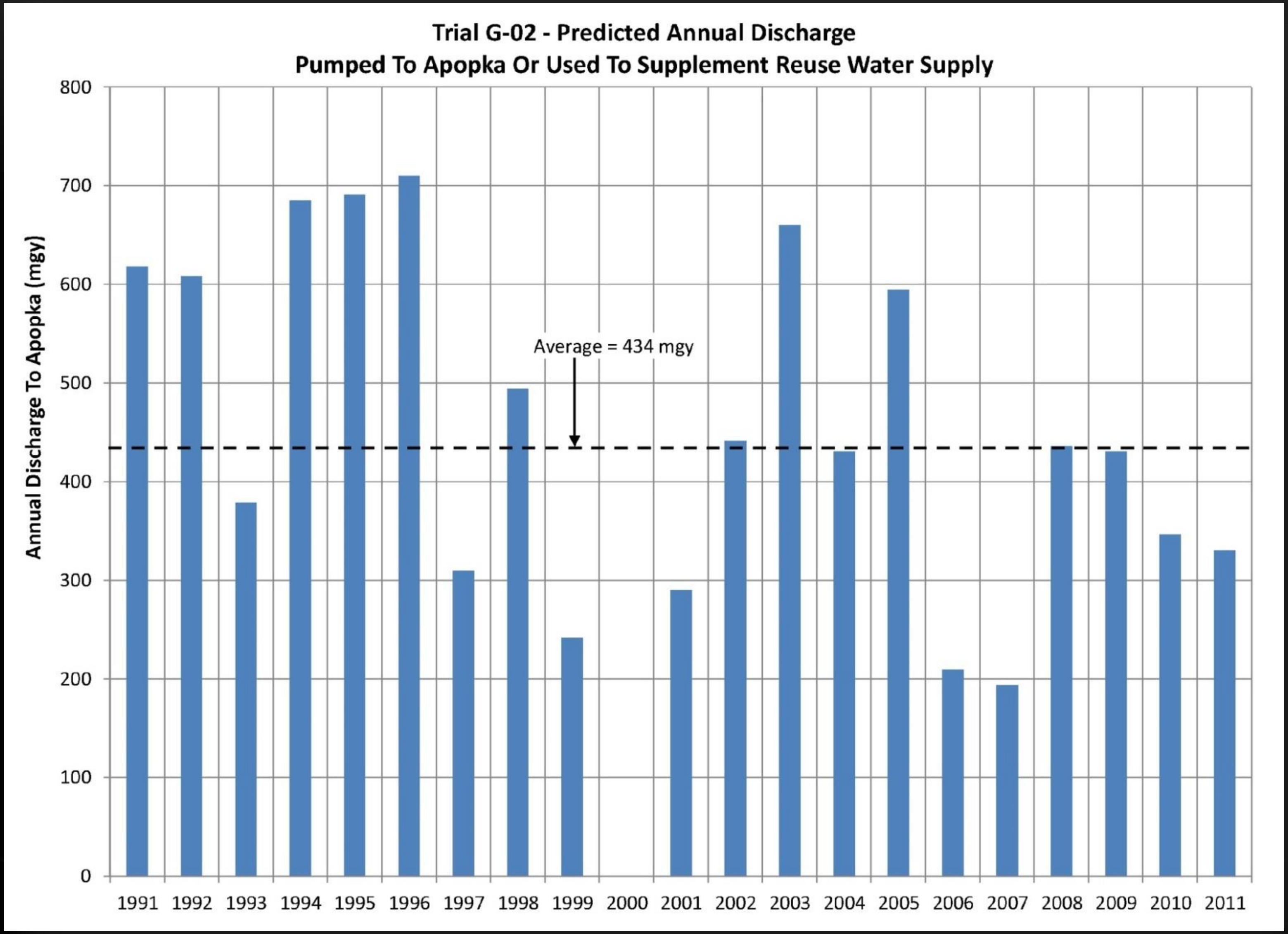
As-Permitted vs Proposed Annual Peak Stage



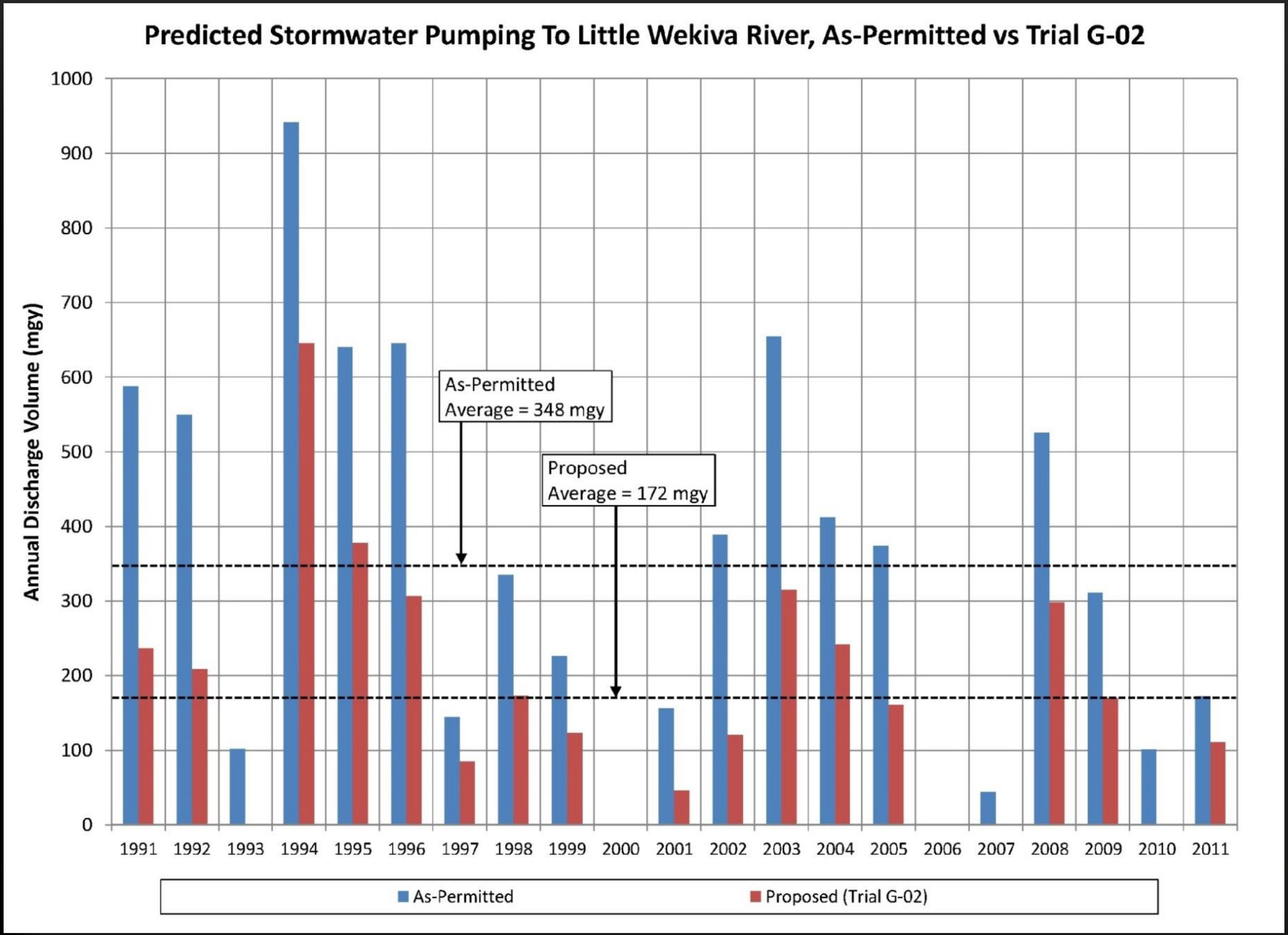
AS-PERMITTED VS PROPOSED PEAK STAGE FOR TS FAY



AVAILABLE SUPPLEMENTAL REUSE WATER



PREDICTED STORMWATER DISCHARGE TO LWR

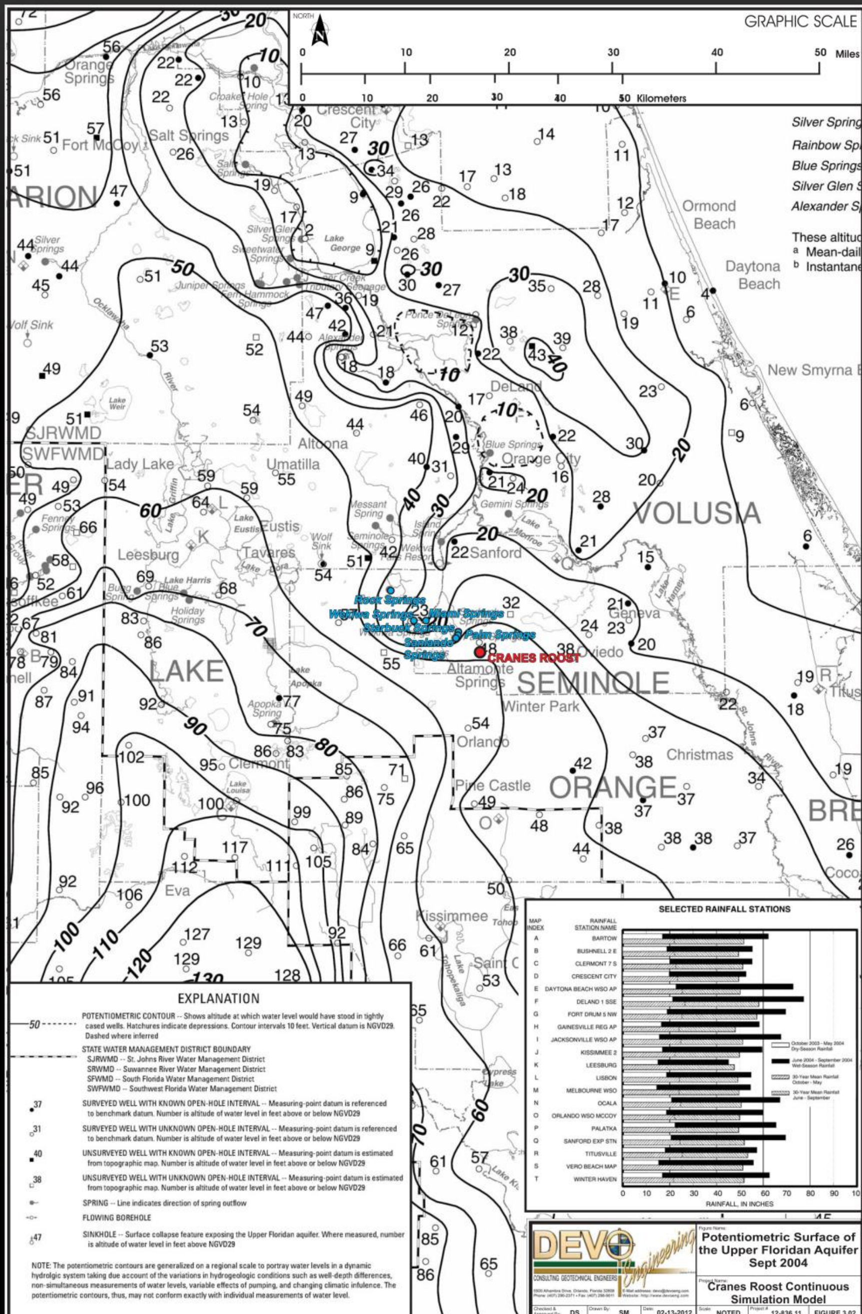


THE BENEFITS

The Benefits

- Elimination of I-4 retention pond & bridge
- 50% reduction in pumping discharge to Little Wekiva River
- Reduction in time that Cranes Roost facilities are not available due to high water/flood conditions
- Reduction in City's reliance on groundwater (Floridan aquifer) augmentation during periods when irrigation demand exceeds the supply of reclaimed water
- Provision of high level outfall for North Lake
- 434 million gallons per year (average) harvest volume now available to Apopka and Altamonte Springs
- Still allows for storage of excess reclaimed water in Cranes Roost when water levels fall below elevation +48 ft NAVD

STORMWATER AND RECLAIMED WATER INTEGRATED PLANS



POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER SEPT.2004

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ALTAMONTE – FDOT INTEGRATED REUSE & STORMWATER TREATMENT

Model Results

Table 3. Summary of Results For Recommended Operating Conditions

Trial Number	As Permitted	Trial G-02	Trial G-03
Max. Pumping Rate to Little Wekiva River (gpm)	7,500	7,500	7,500
Max. Pumping Rate to Apopka (gpm)	N.A.	2,083	2,083
Combined Max. Pump-Out Rate at High Water Level, LWR + Apopka (gpm)	7,500	9,583	9,583
Stormwater Pump-Off Elevation (ft NAVD)	**50.63**	**50.63**	**50.63**
Reuse-In Nominal Pumping Rate (MGD)	**4**	**4**	**0**
Reuse Pumping			
Reuse-In Cutoff Elevation (ft NAVD)	51.5	48	N.A.
Reuse-Out/Apopka Cutoff Elevation (ft NAVD)	46.91	48	48
Reuse-In Nominal Pumping Rate (MGD)	4	4	0
Reuse-Out/Apopka Nominal Pumping Rate (MGD)	1	3	3
Ratio of Reuse In / Reuse Out	4	1.33	N.A.
Stormwater Pumping To Little Wekiva River			
Stormwater Pump-On Elevation (ft NAVD)	52.66	52.66	52.66
Stormwater Pump-Off Elevation (ft NAVD)	**50.63**	**50.63**	**50.63**
Max. Pump Capacity Available For Pumping to Little Wekiva River (gpm)	7,500	7,500	7,500
Cumulative Discharge to LWR For 21 Year Model Period (ac-ft)	22,446	11,113	10,859
Long Term Average Annual Stormwater Discharge (ac-ft/yr)	1069	529	517
Change in Stormwater Pumping Compared to Baseline (%)	N.A.	50.5	51.6
Days with Non-zero Stormwater Pumping To Little Wekiva River (days)	936	399	388
Days with Non-zero Stormwater Pumping To Little Wekiva River (%)	12.2	5.2	5.1
Leakage			
Cumulative Leakage For 21 Year Model Period (ac-ft)	27,141	18,073	15,460
Average Long Term Annual Leakage (ac-ft/yr)	1292	861	736
Change in Leakage From Baseline Conditions (%)	N.A.	33.4	43.0
Reuse-In Pumping			
Reuse In, Cumulative Volume For Model Duration (ac-ft)	15,240	4,593	0
Average Yearly Reuse In Volume (ac-ft/yr)	726	219	0
Maximum Reuse-In Annual Volume (ac-ft/yr)	1115	512	0
Minimum Reuse-In Annual Volume (ac-ft/yr)	320	5	0

Table 3. Summary of Results For Recommended Operating Conditions

Trial Number	As Permitted	Trial G-02	Trial G-03
Pumping To Apopka (or Reuse-Out)			
Cumulative Discharge To Apopka Or Reuse-Out For 21 Year Model Period (ac-ft)	12,548 (reuse out)	27,940	26,240
Average Yearly Discharge To Apopka/Reuse-Out (ac-ft/yr)	598	1330	1250
Average Yearly Discharge As Percentage Of Maximum Potential Discharge (%)	N.A.	39.6	37.2
Maximum Yearly Discharge To Apopka/Reuse-Out (ac-ft/yr)	816	2,180	2,174
Minimum Yearly Discharge To Apopka/Reuse-Out (ac-ft/yr)	30	0	0
Average Yearly Net Reuse-Out [Reuse-Out minus Reuse-In] (ac-ft/yr)	-128	1112	1250
Average Yearly Net Reuse-Out [Reuse-Out minus Reuse-In] (mgy)	-42	362	407
Days With Pumping			
Total Days In Model Period	7670	7670	7670
Days with Non-zero Stormwater Pumping To Little Wekiva River (days)	936	399	388
Days with Non-zero Stormwater Pumping To Little Wekiva River (%)	12.2	5.2	5.1
Days With Reuse-In Pumping (days)	1402	756	0
Days With Reuse In-Pumping (%)	18.3	9.9	0.0
Days With Pumping To Apopka or Reuse-Out (days)	4151	3698	3466
Days With Pumping To Apopka or Reuse-Out(%)	54.1	48.2	45.2
Days with No Pumping (days)	1466	52	4205
Days with No Pumping (%)	19.1	0.7	54.8
Cranes Roost Water Level Highs And Lows			
Number Of Days With Stage Greater Than 54 Ft NAVD	169	109	105
Number Of Days With Stage Less Than 47.5 Ft NAVD	1763	2132	2740
Highest Peak Stage (ft NAVD) [Aug 2008, TS Fay, 12.89 inches in 6 days]	59.1	59.0	59.0
Second Highest Peak Stage (ft NAVD) [Nov 1994, Gordon, 9.61 inches in 4 days]	59.0	58.7	58.7
Third Highest Peak Stage (ft NAVD) [Sep 1999, 6.67 inches in 3 days]	56.3	55.7	55.7
Lowest Drought Stage (ft NAVD) [Jun 2000]	40.4	40.5	39.4
Second Lowest Drought Stage (ft NAVD) [May 2002]	43.9	43.9	42.7
Third Lowest Drought Stage (ft NAVD) [Jun 1998]	44.4	44.3	44.2

Model Results (Cont'd.)