

Attachment 4

Christ Fellowship

Drainage Report and Calculations

Prepared For:
Christ Fellowship Church Inc.

For Review By:
Martin County and South Florida Water Management District

REVISED Nov. 2016

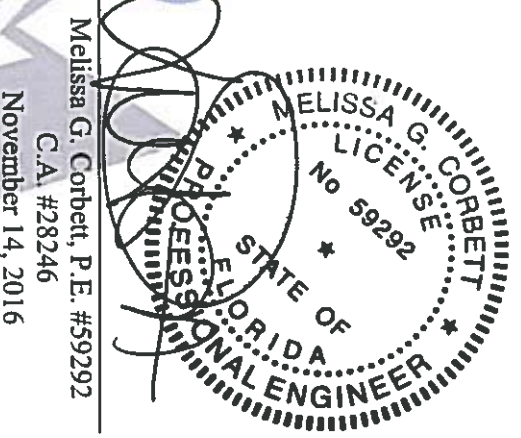
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Christ Fellowship Drainage Report and Calculations

1 Existing Conditions:

1.1 Location

The Christ Fellowship site consists of a church complex, beginning with a worship center and educational building with associated parking located in Sections 8,9,16 and 17, Township 39S, Range 41E, in Martin County. The site is located northeast of the intersection of Pratt Whitney Road and the South Fork High School Access Road and encompasses approximately 321 acres. The site is bound by the Florida Turnpike and South Fork High School to the east, South Fork High School entrance road to the south, Pratt-Whitney Road (County Road 71 1) to the west, and undeveloped wooded areas to the north (Martin County Tropical Farms Water and Wastewater Treatment Expansion parcel).

1.2 Site Conditions

The 321 acre site consists of about 49 acres of existing church development, 251 acres of woods and pastureland, and 15.91 total acres of wetlands in 8 locations. There is also an existing 4.91 acre pond near the northwest corner of the property. The central western portion of the site (54.6 acres) contains an active pasture (cattle grazing). Topography varies from 12.05 feet to 15.05 feet NAVD 88. A 35-foot wide FPL easement intersects the northern 114 of the site, from east to west.

1.3 Soils & Wetlands

According to the Soil Survey of the Martin County Area, Florida, issued by the US Department of Agriculture in January 1987, the existing site soils consist predominantly of the Wabasso-Riviera-Oldsmar sands characteristic of flatwoods areas. These are nearly level, poorly drained soils, sandy to a depth of 20-40 inches.

In accordance with ERP #43-01664-P, the site contains twelve (12) wetland areas.

Wetland #	Acreage	FLUCCS Code	Type	Control Elev. (NAVD)
1	1.92	641	Freshwater Marsh	17.97
2	3.06	641	Freshwater Marsh	16.47
3	0.27	641	Freshwater Marsh	16.47
4	0.35	643	Wet Prairie	15.22
5	1.58	621	Cypress Wetland	16.57
6	0.07	621	Cypress Wetland	16.57
7	3.89	643	Wet Prairie	14.47
8	0.16	621	Cypress Wetland	14.47
9	2.98	641	Freshwater Marsh	14.47
10	0.52	643	Wet Prairie	14.47
11	1.0	641	Freshwater Marsh	15.47
12	0.09	643	Wet Prairie	14.47

Please note:

- Wetlands 2 and 3 are one contiguous 3.33-acre wetland.
- Wetlands 5 and 6 are one contiguous 1.65-acre cypress wetland.
- Wetlands 7, 8, and 9 are one contiguous 7.03-acre wetland; however, they consist of different community types.
- Wetland 11 is a freshwater marsh that extends offsite to the north; the onsite portion of Wetland 11 is listed above.

In general, the onsite wetlands are in fair ecological condition. All of the onsite wetlands will be preserved with associated upland buffer areas as part of the development plan.

The applicant will install permanent signs designating the preserve status of the wetland preservation areas. There are no wetland impacts proposed.

1.4 Drainage Pattern

The site generally drains from west-to-east. There are three main conveyance mechanisms in place on site:

1st Conveyance System: Consists of a wetland chain that connects an existing box culvert under Pratt Whitney Road to a pair of 54" ADS pipes on the east property line.

2nd Conveyance System: An existing ditch south of the wetland chain that runs from the west property line to an existing 30" CMP on the east property line.

3rd Conveyance System: An existing ditch that runs from the South Fork High School Access Road northeast to an existing 48" ADS pipe at the east property line. This third ditch is connected to an existing 30" CMP that runs south under the Access Road and drains a portion of an existing 20 acre nursery. A small portion of the Foxwood development to the south also drains through this culvert via the nursery.

1.5 Discharge Rate / Off-Site Pass Through Drainage

In accordance with ERP #43-01664-P, the pre-development discharge rate for the site is 29.66 cfs.

There are three off-site pass through drainage flows that shall be left in their natural state:

Harmony: The wetland chain (Conveyance System #1) that runs from west-to-east across the project conveys offsite runoff from the future Harmony Subdivision site (27.3 cfs from Harmony, Permit 43-00087-S-06) to the west and discharges it through existing twin 54" ADS pipes on the east side of the project. No alteration of this wetland chain is proposed, with the exception of installing the pipes and structures that were permitted under ERP #43-01664-P.

Foxwood: Approximately 17 acres of the Foxwood subdivision and 10 acres of an existing nursery to the south drain into one of these ditches (Conveyance System #3) at a rate of 12.37 cfs using criteria from Foxwood permit 43-00096-S.

Pratt Whitney Road: Approximately 2 acres of roadside swale drain into the project site and flow through Conveyance System #2 at a rate of 0.30 cfs using TR-55 calculations.

1.6 FEMA Flood Zone

The site is located in FEMA Flood Zone X, areas determined to be outside the 0.2% annual chance floodplain. Please refer to the FEMA FIRM Map, dated March 2015, in the attachments.

2 Proposed Development:

2.1 Project Description:

The proposed project consists of the addition of 260 pervious parking spaces to the existing church complex located within the 49.10 acre stormwater management system.

Below is a summary of the land use breakdown within the stormwater management system area:

Stormwater Management System Land Use	Basin 1 Area (Ac)	Basin 2 Area (Ac)	Basin 3 Area (Ac)	Basin 4 Area (Ac)	Total Area (Ac)	Percent
Building	1.10	0	0	0	1.10	2.24%
Existing Pavement	5.69	0	0	0.90	6.59	13.42%
Proposed Pavement	1.58	0	0	0	1.58	3.22%
Existing Sidewalk & Curb	0.58	0	0.10	0	0.68	1.38%
Proposed Sidewalk & Curb	0.03	0	0	0	0.03	0.06%
Lake - TOB	0.60	0.60	0	0	1.20	2.44%
Lake - EOW	2.40	2.90	0	0	5.30	10.79%
Existing Pavers, Grass Parking and Rock Road (50% impervious)	2.54	0	1.50	0	4.04	8.23%
Proposed Pavers, Grass Parking and Rock Road (50% impervious)	1.24	0	0	0	1.24	2.53%
Green Area	9.64	10.10	2.50	1.30	23.54	47.94%
Swale Bottom	0.60	0	2.50	0.70	3.80	7.74%
Total Design Acreage	26.00	13.60	6.60	2.90	49.10	100.00%

The balance of the 321 acres shall be left in the native state. Below is a summary of the land use breakdown within the entire site.

Total Site Area Land Use	Area (Ac)	Percent
Building	1.10	0.34%
Existing Pavement	6.59	2.05%
Proposed Pavement	1.58	0.49%
Existing Sidewalk & Curb	0.68	0.21%
Proposed Sidewalk & Curb	0.03	0.01%
Lake - TOB	1.20	0.37%
Lake - EOW	5.30	1.65%
Existing Pavers, Grass Parking and Rock Road (50% imperv)	4.04	1.26%
Proposed Pavers, Grass Parking and Rock Road (50% imperv)	1.24	0.39%
Green Area	298.29	92.93%
Swale Bottom	3.80	1.18%
Total Site Acreage	321.00	100.00%

2.2 Control Elevation:

Control elevations are in accordance with ERP #43-01664-P, but converted from NGVD 29 to NAVD 88, which requires an adjustment of (-)1.46 feet.

2.3 Drainage Basins:

The development has been divided into four (4) separate drainage basins, as described below:

Basin 1:

Basin 1 consists of the majority of the development, 26.00 acres, including the two buildings and associated parking, and is constructed per ERP #43-01664-P. The stormwater management system consists of a series of inlets and pipes that connect to a proposed lake and series of swales. The control elevation for this basin is 14.29 feet NAVD 88.

The proposed modifications in this submittal consists of additional parking in this basin and modification of the control structure to include a 37 inch wide weir set at the water quality storage elevation of 15.89' NAVD 88 above the existing 4" bleeder set at control elevation.

The minimum elevation of the constructed and proposed parking is above the 5-year/1-day peak stage at 16.00 feet NAVD 88. The minimum elevation of the road is above the 10-year/1-day elevation at 16.44 feet NAVD 88. A perimeter berm has been constructed above the 25-year/3-day peak stage at 17.04 feet NAVD 88. The buildings were constructed with a finished floor above the 100-year/3-day zero discharge event at 17.69 feet NAVD 88. Basin 1 received the 0.30 cfs of runoff from Pratt Whitney Road, for which water quality is provided.

Basin 2

Basin 2 is fully constructed and ***no changes are proposed***. The basin consists of a lake planted with littoral plantings, and stockpile area encompassing 13.60 acres. There are no buildings, parking lots, or roads associated with this basin. The control elevation for this basin is 11.54 feet NAVD 88, and water quality is met at elevation 11.93 feet NAVD 88. Design calculations were based upon detention in this basin. The maximum stage of the 25-year/3-day storm was determined to be 12.81 feet NAVD 88 using ICP3 modeling software that included an existing 3.0" bleeder set at control elevation within the model. A perimeter berm has been constructed above the 25-year/3-day stage at the lake top of bank elevation of 13.55 feet NAVD 88. Any runoff that exceeds the perimeter berm will outfall through the existing central wetland system or two existing ditches with no modifications to these facilities.

Basin 3

Basin 3 is constructed in accordance with a minor site plan amendment, and consists of a shellrock road and water quality swale, encompassing 6.60 acres. ***No changes are proposed***. The control elevation for this basin is 11.54 feet NAVD 88, and water quality is met at elevation 12.76 feet NAVD 88. Due to the magnitude of pervious area, design calculations were based on retention in this basin. The minimum road elevation is set above the 10-year/1-day elevation at 14.24 feet NAVD 88. A perimeter berm has been constructed above the 25-year/3-day peak stage at 14.54 feet NAVD 88. A 3.0" bleeder has been constructed at control elevation. Any runoff that exceeds the perimeter

elevation will outfall threw either the existing central wetlands system or remain on site in the large open green areas and infiltrate.

Basin 4

Basin 4 is fully constructed, and ***no changes are proposed.*** The basin consists of a road and water quality swale, encompassing 2.90 acres. The balance of the basin is green space. The control elevation for this basin is 14.04 feet NAVD 88. In April 2014, the roadway elevations within this basin were raised 1.5-ft due to the amount of water seen on-site during construction. Water quality is met at elevation 15.53 feet NAVD 88. Due to the magnitude of pervious area, design calculations were based on retention in this basin. The minimum elevation of the road is above the 10-year/1-day elevation at 16.34 feet NAVD 88. A perimeter berm is proposed above the 25-year/3-day stage at 16.79 feet NAVD 88. A 3.0" bleeder has been constructed at control elevation. Any runoff that exceeds the perimeter elevation will outfall to the southern-most existing ditch. Off-site pass-through drainage of 12.37 cfs from the south (Foxwood subdivision and nursery) flows through this basin via the same existing ditch. This ditch is to remain unaltered, except for the roadway crossing that has been piped. The 25-year, 72-hr storm event berm is located along the edge of the road so that runoff cannot directly enter this ditch.

3 Modeling:

3.1 Storm Events

Storm Event:	Criteria:	Rainfall Amount (inches):
5-yr, 1-day	Parking Lot Elevation	6.0 inches
10-yr, 1-day	Roadway Elevation	7.0 inches
25-yr, 3-day	Perimeter Elevation	11.0 inches
100-yr, 3-day	Finished Floor Elevation	14.0 inches

3.2 Storm Event Peak Stages vs. Minimum Elevations

	Control Elev. (NAVD)	Water Quality Stage (NAVD)	5-yr, 1-day Stage (NAVD)	Min. Parking Elev. (NAVD)	10-yr, 1-day Stage (NAVD)	Min. Road Elev. (NAVD)	25-yr, 3-day Stage (NAVD)	Perimeter Berm Elev. (NAVD)	100-yr, 3-day Stage (NAVD)	Min. Finished Floor Elev. (NAVD)
Basin										
1	14.29	15.89	15.62	16.00	15.87	16.44	16.43	17.04	17.49	17.69
2	11.54	11.93	N/A	N/A	N/A	N/A	12.81	13.55	N/A	N/A
3	11.54	12.76	N/A	N/A	12.57	14.24	12.80	14.54	14.32	15.21
4	14.04	15.53	N/A	N/A	15.56	16.34	15.98	16.79	N/A	N/A

3.3 Peak Discharge Rates

In accordance with ERP #43-01664-P, the pre-development discharge rate for the site is 29.66 cfs. Bleeders have been designed for system recovery in accordance with SFWMD requirements of a 1/2 inch of the detention volume in 24 hours. ICPR has been run to verify the peak discharge rate during the 25-year, 3-day design storm:

Discharge Summary	
Basin	Discharge Rate (cfs)
1	9.22
2	3.45
3	2.82
4	0.32
Total	15.81

3.4 Retention Recovery

ICPR has been utilized to determine that the systems recover from both the 10-year, 24-hour storm event and the 25-year, 72-hour storm event. Per Martin County, 50% of the volume must be recovered in five days and 90% in 12 days.

	Storm	Peak Stage	Time	Recovery Elev
Basin 1: <i>Lake Elev</i> =	10-yr, 1-Day	15.87 ft NAVD	120 hours (5 days) 288 hours (12 days)	14.31 ft NAVD 14.30 ft NAVD
14.29	25-yr, 3-Day	16.43 ft NAVD	120 hours (5 days) 288 hours (12 days)	14.36 ft NAVD 14.30 ft NAVD
Basin 2: <i>Lake Elev</i> =	10-yr, 1-Day	12.14 ft NAVD	120 hours (5 days) 288 hours (12 days)	11.55 ft NAVD 11.54 ft NAVD
11.54	25-yr, 3-Day	12.81 ft NAVD	120 hours (5 days) 288 hours (12 days)	11.58 ft NAVD 11.55 ft NAVD
Basin 3: <i>Detention</i>	10-yr, 1-Day	12.57 ft NAVD	120 hours (5 days) 288 hours (12 days)	12.54 ft NAVD 12.54 ft NAVD
12.54	25-yr, 3-Day	12.80 ft NAVD	120 hours (5 days) 288 hours (12 days)	12.54 ft NAVD 12.54 ft NAVD
Basin 4: <i>Detention</i>	10-yr, 1-Day	15.56 ft NAVD	120 hours (5 days) 288 hours (12 days)	15.04 ft NAVD 15.04 ft NAVD
15.04	25-yr, 3-Day	15.98 ft NAVD	120 hours (5 days) 288 hours (12 days)	15.04 ft NAVD 15.04 ft NAVD

4 Attachments

4.1 Post Development Drainage Basin Map

4.2 Drainage Calculations

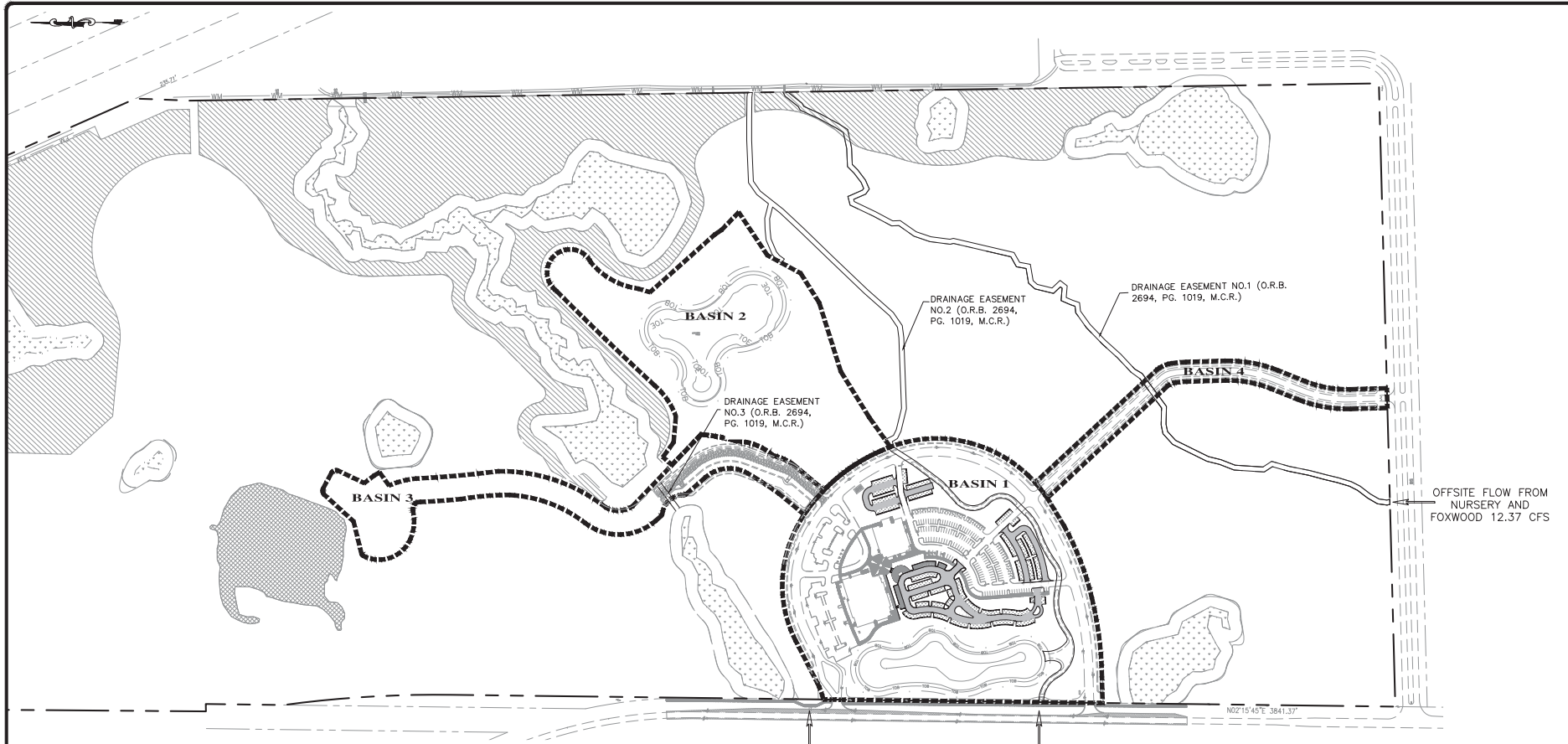
- Area calculations per basin
- Stage storage calculations per basin
- Pratt Whitney Road Runoff
- Bleeder sizing calculations
- Wetland Drawdown / Hydraulic Gradient Calculation
- 5-year, 24-hour Pervious Parking Calculation
- ICPR Overall Recovery Model
- ICPR Input

4.3 Stormwater Maintenance Plan

4.4 FEMA FIRM Map

4.5 ERP # 43-01664-P, Application #150203-7 which adjusted the control elevations.

Please note that all elevations listed in this application are in NGVD 29. To convert to NAVD 88 (-) 1.46 feet. Application #160414-8 reflecting the proposed parking modifications, application 161017-16 reflecting topographical corrections to application #160414-8, and pages 1-4 from application #120926-4 documenting the maximum allowable discharge are also attached.



BASIN	CONTROL ELEV (NAVD)	WATER QUALITY STAGE (NAVD)	5-YR, 1-DAY STAGE (NAVD)	MIN. PARKING ELEV (NAVD)	10-YR, 1-DAY STAGE (NAVD)	MIN. ROAD ELEV (NAVD)	25-YR, 3-DAY STAGE (NAVD)	PERIMETER BERM ELEV (NAVD)	100-YR, 3-DAY STAGE (NAVD)	MIN. FINISHED FLOOR ELEV (NAVD)
1	14.29	15.89	15.62	16.00	15.87	16.44	16.43	17.04	17.49	17.89
2	11.54	11.93	N/A	N/A	N/A	N/A	12.81	13.55	N/A	N/A
3	11.54	12.76	N/A	N/A	12.57	14.24	12.80	14.54	14.32	15.21
4	14.04	15.53	N/A	N/A	15.56	16.34	15.98	16.79	N/A	N/A

Discharge Summary

Basin	Discharge Rate (cfs)
1	9.22
2	3.45
3	2.82
4	0.32
Total	15.81

CONTROL STRUCTURE TABLE

CONTROL STRUCTURE	BLEEDER SIZE	BLEEDER SHAPE	BLEEDER INVERT	WEIR ELEV (NAVD)	WEIR SIZE	GRATE ELEV (NAVD)
CS-1	4" Dia.	Circular	14.29	15.89	37" wide	17.04
CS-2	3" Dia.	Circular	11.54	13.55	grate	13.55
CS-3	3" Dia.	Circular	11.54	14.54	grate	14.54
CS-4	3" Dia.	Circular	14.04	16.79	grate	16.79

ALL ELEVATIONS SHOWN ARE IN NAVD 88 DATUM,
FOR NGVD DATUM ADD 1.46'.

STATE OF FLORIDA
PROFESSIONAL ENGINEER
No. 150016
Exp. 12-31-16

Designed: M.C.C. 8-21-16
Drawn: M.C.C. 8-21-16
Checked: M.C.C. 8-21-16
Approved: M.C.C. 8-21-16
Date: 8-21-16
Project: 0501 AP
File: 0501 AP BASE.dwg

REVISIONS FOR ME STAFF COMMENTS

No.	Date	Description
1	8-21-16	REVISED FOR ME STAFF COMMENTS
2	8-21-16	REVISED FOR ME STAFF COMMENTS
3	8-21-16	REVISED FOR ME STAFF COMMENTS

REVISIONS FOR ME STAFF COMMENTS

No.	Date	Description
1	8-21-16	REVISED FOR ME STAFF COMMENTS
2	8-21-16	REVISED FOR ME STAFF COMMENTS
3	8-21-16	REVISED FOR ME STAFF COMMENTS

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POST DEVELOPMENT DRAINAGE BASIN MAP

CHRIST FELLOWSHIP START CAMPUS ADDITIONAL PARKING

WORTH COUNTY, FLORIDA

Sheet No.

1