MEMORANDUM

To: Elizabeth Wong, PE (City of North Port)
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Subject: Task 1.1.3 Big Slough Flood Reduction Study, Summary of Prior BMP Evaluations

November 21, 2016

Summary of Prior BMP Evaluations

The Big Slough watershed and City of North Port stormwater management system have been the subjects of prior investigations. The Big Slough Flood Reduction Study will build upon that prior work to advance previously developed concepts and develop original ideas to achieve some degree of flood mitigation in areas where residential structures are shown as flooding in recently updated Flood Insurance Rate Maps (FIRMs). Flood reduction performance of proposed improvements will be considered relative to storm events from mean annual to the 100-year recurrence to more broadly evaluate cost and benefit relationships. This memorandum briefly summarizes prior BMP evaluations that were performed and their findings, using much of the same language found in those prior reports.

Stormwater Management Master Plan (1993)

As part of the City of North Port's stormwater improvement program, Camp Dresser & McKee, Inc. (CDM) developed a Stormwater Management Master Plan (SWMMP) for the Big Slough watershed. The plan sought to evaluate flooding problems and determine engineering solutions, and was conducted in three phases. The third phase included analyses of alternatives for flood reduction. Detailed modeling was conducted to assess potential flood reduction afforded by alternatives. A cost/benefit analysis was conducted to evaluate the alternatives and recommend a plan for detailed design.

Development of Conceptual Solutions

A Phase III, Task l interim report (CDM, 1992) outlined conceptual solutions to identified flooding problems. Preliminary stormwater model runs were conducted to provide an initial assessment of each solution's effectiveness in reducing flooding. Results and preliminary cost estimates were developed for each solution. The costs and benefits of each conceptual solution were compared in a matrix.

Solutions considered in the preliminary evaluation included the following:

- Acquisition: Purchase of flooded lands would preclude flooding damage by preventing the development of the property, but would not prevent roadway flooding.
- Storage: Construction of stormwater detention basins would detain flow from the agricultural areas north of the city would reduce and attenuate peak flow rates.
- Diversion: Stormwater flows would be diverted into an adjacent watershed to the west (Deer Prairie Slough), thus reducing flow through the city.
- Conveyance: Increased conveyance capacity of the city's hydraulic system would include excavating existing channels, resizing culverts at stream crossings, cleaning existing channels, and constructing relief channels parallel to existing channels.

Based upon preliminary analyses, purchase of flooded lands was removed from consideration and the three remaining alternatives, and combinations of those alternatives, were examined in more detail.

Evaluation of Alternatives

City of North Port Big Slough Watershed Study Phase III Task 2 Final Report, Stormwater Management Master Plan (CDM, 1993) presents conceptual solutions for flooding as well as assessments of potential water supplies and of nonpoint source pollution and describes a stormwater management plan to reduce flooding during extreme storm events.

The specific set of alternatives evaluated in greater detail included:

- Alternative 1: Relief channel+ culvert improvements
- Alternative 2: Stormwater diversion by pumping + culvert improvements
- Alternative 3: Stormwater diversion by channel + culvert improvements
- Alternative 4: Upstream detention
- Alternative 5: Combination of Alternatives 1 and 2
- Alternative 6: Combination of Alternatives 1 and 3

Culvert improvements were recommended for the first phase of each alternative and included replacement of culverts on the R-36 canal at Bullard and Biscayne and on Cosmic and Creighton waterways at Tropicaire Blvd. Cleaning of portions of the Creighton and Cosmic waterways was also recommended to return those canals to original design dimensions. Flood reduction effects from the culvert improvements would be predominantly local, but some flooding would also be relieved by transferring flow from the upper reaches of the Big Slough and R-36 to the R-580 and Snover waterways.

The relief channel (Alternative 1) under consideration would reach from the northern boundary of the city to the Snover waterway. It could act as a parallel conveyance for peak storm flows and be integrated into a linear park system along the Big Slough. The channel would be 5 feet deep, have gentle grassed side slopes, and would be dry except during extreme storm events. When the relief channel is combined with the culvert improvements, the expected flooded area would be reduced by 540 residences.

The diversion alternative had two options: a pumping option and a channel option. The diversion pumping option (Alternative 2) would require a pumping station with a weir near Price Boulevard on the R-36 canal to convey stormwater to a bermed storage area on the Futrell tract. Release from the tract to Deer Prairie Slough would be at the existing rate and would take about a week to drain down under 25-year/24-hour storm conditions. Normally, pumping would only be initiated under high storm flow (2 feet above weir crest) conditions. To minimize noise, primary power would be by direct connection to Florida Power & Light with a diesel generator back-up.

The diversion channel option (Alternative 3) would utilize two weirs for diversion to a channel south of the Futrell tract, directly connected to the Deer Prairie Slough. The weir discharge rate would closely match the pumping capacity and would also discharge only under storm conditions. Both the pumping and channel options would have similar results by reducing downstream flooding along the R-36 canal. They provide flood relief only in the southwest area of the city, but more than 1,000 residences would benefit from this alternative by diverting water from the existing flooding area.

Upstream detention (Alternative 4) would consist of a berm designed to detain flood waters north of the city and slowly release those waters after the peak flows had passed. Six foot berms were proposed with a total storage capacity of 4,011 acre feet and 1 foot of freeboard. Little flood reduction was evident when compared to the other alternatives. The amount of land necessary and the limited benefit restricted the viability of this alternative.

Alternatives 5 and 6 combined the relief channel with each of the diversion alternatives. Simulation results indicated a significant reduction in flooding along Sumter Boulevard, as well as those areas mentioned previously. A reduction in flooded land of 4,200 acres, 1,152 residences, and 10.1 miles of roadway was predicted from the modeling.

Flooding problems along the Cocoplum Waterway were not alleviated by any of the suggested alternatives. Preliminary modeling results indicated that structural solutions to the flooding problems along the Cocoplum Waterway are cost-prohibitive. Consequently, non-structural measures should be considered.

Comparison of Alternatives/Recommendation

Alternatives were evaluated per the following weighted criteria:

- Flood protection benefit (10 point maximum)
- Annual cost (30 point maximum)
- Implementability (20 point maximum)
- Water quality benefits (10 point maximum)
- Water supply benefits {10 point maximum)

Evaluation results indicated that Alternative 2 (diversion pumping option to Futrell tract coupled with culvert improvements) scored highest (62 total points). Alternative 5, which is Alternative 2 with the addition of the relief channel, was tied for second place (60 points) with Alternative 3 (diversion channel

option plus culvert improvements). While total scores were close, Alternative 5 provided considerably more flood protection than Alternatives 2 and 3. Alternative 5 was recommended because it included the top ranked alternative, provided the greatest flood protection benefit, and could be phased.

The culvert improvements and the stormwater diversion phases were recommended first because they addressed existing flooding problems in an area of the city that is already populated. The relief channel would provide much of its benefit in areas that are currently sparsely populated but expected to grow.

For the Cocoplum Waterway, non-structural methods of flood reduction were recommended, since any feasible structural measures would be cost-prohibitive. Measures to be considered included specifying minimum first floor elevations in the city's zoning requirements, based on the 25-year or 100-year flood maps. For existing development, primarily around Blueridge Lake, local measures were recommended, such as raising structures, constructing small walls or levees around structures, and adding watertight flood shields for windows and exterior doors. While these measures will not reduce roadway flooding, they will reduce the potential structural damage from an extreme storm event.

Status of Recommendations

The 1993 Stormwater Management Master Plan was partially implemented, providing increased local conveyance through replacement of culvert structures at four locations. Those improvements are accounted for in the current Existing Conditions model. Other plan components were not completed including those for storage and flow diversion, apparently due to regulatory and financial constraints.

Watershed Management Program Consulting Services in the Big Slough Watershed (2014)

Ardaman & Associates, Inc. evaluated various BMP alternatives to address flooding conditions based on effectiveness, permittability, and economic viability. Under the WMP project, an Existing Conditions model was developed and six regional BMP alternatives were evaluated that could potentially reduce flooding through combinations of conveyance improvements, stormwater management storage areas, flood proofing, and flow diversion. Although the regional alternatives developed under the WMP project were not incorporated into a specific plan for implementation, the work provides insight to the system's hydraulic response and BMP limitations. Performance of several additional, site-specific BMPs were also evaluated and are also briefly discussed, here.

Regional BMPs

Simulations were performed of six regional BMP scenarios to evaluate the impact of various large-scale flood mitigation concepts. The benchmark scenario for comparison and performance evaluation was the SWFWMD Governing Board-approved 100-year 24-hour existing condition model.

- Remove structures throughout City of North Port waterways.
    - The objective of evaluating this BMP was to understand primary drainage system capacity assuming no losses due to water control structures or drop structures. Additional connectivity was provided among a few R canals southwest of the I-75 corridor to transferring some of the existing load to less compromised areas.

  - Water control structures (WCS) and drop structures (DS) were removed and replaced with an equivalent channel section that mimics the immediate upstream canal's section. The R-36 canal was connected to the R-43 canal via a weir with equivalent channel geometry and the R-43 canal was similarly connected to the R-24 and R-32 canals.
  - Results indicate flood stage reduction immediately north of Price Blvd and along Bass Point waterway while increasing flooding between S Toledo Blvd and S Sumter Blvd. Also, improvements are observed southwest of I-75 where new canal connectivity was provided. It was noted that structure removal may not be feasible due to potential loss of potable water supply, fish and wildlife habitat, and wetlands.
- Constrain Flow Entering City of North Port at Big Slough Canal
  - The objective of this BMP was to constrain the volume of water coming from offsite areas through the Big Slough canal prior to entering the City in the Estates area. The BMP would involve real estate acquisition, maintenance activities, dam construction and removal of existing hydraulic structures.
  - On the northwest City boundary, at the intersection of Big Slough canal with R-36 and R-580 waterways, all existing earthen weirs were raised to limit runoff from offsite areas, leaving the Big Slough canal as the only conveyance system into the western portion of the City. All earthen weirs farther north, at the intersection of Big Slough canal and Power Line Road were raised as well.
  - Results indicate approximately 0.5 feet flood stage reduction near the Big Slough canal from the City's northern boundary to just south of I-75 while flood stages increase approximately 1.0 foot in offsite areas north of the R-36 and R-580 waterways.
- Diversion Alternative
  - The purpose of this BMP is to divert flows from offsite areas via the existing R-36 canal, by increasing its capacity and improving its hydraulic connectivity with Deer Prairie Slough canal. This BMP would involve construction of new structures, maintenance activities, real estate acquisition, and detailed hydrologic and hydraulic evaluation of the western boundary (Deer Prairie Slough watershed).
  - On the northwest boundary, along R-36 canal, two earthen overflow weirs were provided to enhance the R-36 waterway connectivity with Deer Prairie Slough canal. Weir location and parameters were selected based on terrain and hydraulic constraints. The weirs were located on the northwest corner to address flooding in the Estates area and along Big Slough canal. R-36 canal capacity was also doubled by replacing the existing cross-section with a 60 feet bottom width trapezoidal channel with 4:1 side slopes. The current model assumes no tailwater influence from Deer Prairie Slough.
  - Results indicate flood reduction throughout the Estates area, along the Big Slough Canal between the R-36 canal and I-75 corridor as well as in the localized area along Big Slough south of I-75, with flood stage reductions between 0.1 foot and 1.0 foot throughout those areas. Impacts of additional flow into the Deer Prairie Slough watershed were not considered.

- R-580 Improvements
    - The purpose of this BMP is to induce additional flows through Creighton waterway by improving conveyance capacity in the R-580 waterway.
    - The R-580 waterway's bottom profile was reconfigured, assuming a flat ditch along its entire length at elevation 15.0 feet, NAVD. The current bottom sags to elevation 15.0 feet and reaches 17.7 feet and 23.0 feet at its western and eastern ends, respectively.
    - Results indicate small improvements near Big Slough. However, inducing additional flow through Creighton Waterway causes additional flooding near I-75.
- Increase Capacity on Southern Boundary
    - The objective of this alternative was to evaluate system response when doubling the southern boundary discharge capacity along the County line into Port Charlotte. The BMP would involve conveyance improvements, construction of new structures and/ or reconditioning of existing structures, maintenance activities, real estate acquisition, and evaluation of the receiving waters through hydrologic and hydraulic modeling.
    - All structures within Cocoplum Waterway and discharging beneath Hillsborough Boulevard were doubled in size. This included 6 lateral weirs along Cocoplum waterway and 13 structures beneath Hillsborough Boulevard.
    - Results indicate that improvements relative to house flooding were not significant. However, roads experienced a considerable flood reduction between S Sumter Blvd and Atwater Drive. This alternative was evaluated for information purposes only, as it is understood that allowing additional flows into Port Charlotte may not be desirable.
- Upstream Detention Alternative
    - The objective of this analysis is to examine the effects when attenuating peak flow rates in agricultural areas along the Big Slough canal with a series of new detention facilities. This BMP would involve construction of stormwater management storage areas, maintenance activities and real estate acquisition.
    - Seven detention facilities were added to the model in upstream offsite areas. Each detention area has a 100-acre footprint and is more than 10 feet deep. These areas were located on upland sites along Big Slough canal where feasible. Bottom elevations of the detention areas were set at the adjacent canal initial water level. Each was linked to the Big Slough canal by a 500-foot weir. Weir crest elevations were set at the bottom of the pond. The total anticipated detained volume is 600 acre-feet per detention site for a total of 4,200 acre-ft.
    - Results indicate relatively small reduction in peak water surface elevations on the order of 0.1 to 0.6 feet along Big Slough. The extent of flooding for this BMP is essentially the same as the existing scenario with few flood reduction areas along the Big Slough canal.

BMP Evaluation of Four Road Crossings

Simulations were performed to assess hydraulic performance and the effects of potential conveyance improvements at four sites, including: R-36 Canal at I-75, Myakkahatchee Creek at I-75, R-36 Canal at Tropicaire Boulevard, and Myakkahatchee Creek at Tropicaire Boulevard. A systematic evaluation was

conducted to understand existing hydraulic behavior at each of the four crossings under various synthetic storm events. Head differences across each structure, flow conditions at peak discharge, and hydraulic connectivity (including flow patterns in adjacent areas) were reviewed at each crossing.

To evaluate effectiveness of potential BMP improvements at these four locations (including resulting flood reduction and/or downstream flood increase), conveyance capacity at each site was increased by doubling the number of existing structures. This was achieved by adding a duplicate set of model reach elements at each location.

- R-36 Canal at I-75 Evaluation
    - Existing condition model results indicate that more than two feet of head difference occurs across this structure during the 100-year storm event. Under proposed BMP conditions, model results indicate that a peak stage reduction of up to 0.6 feet occurs upstream of the crossing, while a stage increase of approximately 0.6 feet occurs in downstream areas. It is notable that reduced discharges are observed from the R-36 Canal westward into the adjacent Deer Prairie Slough watershed for the proposed BMP condition. This overflow connection with the adjacent watershed to the west is located north of I-75. The reduced overflow results in an increased total volume remaining within the North Port area, by virtue of the improved conveyance capacity of the proposed BMP.
    - Increasing the crossing capacity of the R-36 Canal at I-75 may reduce water levels upstream of the crossing, but also raises flood elevations in the downstream areas. Mitigation of flooding in downstream areas was beyond the scope of this evaluation.
- Myakkahatchee Creek at I-75 Evaluation
    - Existing condition model results indicate that approximately one foot of head difference occurs across this structure during extreme storm events. This head difference is relatively small considering the magnitude of flow that arrives from the upstream contributing watershed (up to 8000 cubic feet per second). The applied BMP at this location assumes that the conveyance capacity of the bridge crossing was doubled. In other words, an identical, parallel 540-foot bridge span was added to investigate the benefit of increasing bridge capacity. Under this hypothetical scenario, model results indicate that a localized stage reduction of 0.7 feet is observed immediately at the upstream end of the crossing. However, peak stage reductions decrease further upstream of the crossing along the creek. No significant change in peak elevations is observed 1,200 feet upstream of the crossing. Also, no significant change to flooding conditions is observed in areas downstream of the crossing.
    - Increasing conveyance capacity of the bridge over Myakkahatchee Creek at I-75 may reduce water levels immediately upstream of the crossing, but does not generally improve flooding conditions north of I-75. The area impacted by this improvement is very localized and would not justify the cost of the improvement.

- R-36 Canal at Tropicaire Boulevard Evaluation
    - Existing condition model results indicate that up to three feet of head difference occurs across this structure during various storm events. Under proposed BMP conditions, model results indicate a peak stage reduction of approximately 0.8 feet upstream of the crossing, while a stage increase of up to 1.1 feet occurs downstream of Tropicaire. During all events, discharges from the R-36 canal into Deer Prairie Slough watershed are observed north of Tropicaire Boulevard. The proposed BMP results in a reduction of those discharges to Deer Prairie Slough and a resulting increased total volume remaining within the North Port area.
    - While increasing the crossing capacity of the R-36 Canal at Tropicaire Boulevard may reduce water levels upstream of the crossing, it also raises flood elevations in downstream areas. Mitigation of flooding in downstream areas was beyond the scope of this evaluation.
- Myakkahatchee Creek at Tropicaire Boulevard Evaluation
    - Existing condition model results indicate that the maximum calculated head difference for the various storm events is 0.2 feet; therefore, the bridge is not causing a flow restriction. Regardless, a BMP was applied, for evaluation, and assumes that the conveyance capacity was increased (doubled) by adding an identical bridge element in parallel to the existing structure. Under this scenario, model results indicate that a maximum localized stage reduction of approximately 0.1 feet was calculated, yet no significant change is observed further upstream nor downstream of the crossing.
    - Increasing the crossing capacity of the bridge over Myakkahatchee Creek at Tropicaire Boulevard does not substantially improve flooding conditions north of I-75.

WCS-162 Evaluation

WCS-162 is located on the R-36 Canal, north of Interstate 75, and immediately upstream of Tropicaire Boulevard. This is the only gated weir structure on the R-36 Canal, with one 2.25 feet high by 2 feet wide pull up slide gate. The City generally operates this structure by fully opening the gate in anticipation of a storm event to lower the water level in the R-36 canal to minimize potential upstream flooding; otherwise, the gate remains closed. The City staff would like to determine if adding gates would help draw down the canal more quickly and increase conveyance capacity.

- R-36 Canal Drawdown Evaluation
    - To reduce impacts downstream of WCS-162 while improving peak conditions upstream of the structure, an evaluation was performed to determine the benefits of adding additional gates. The evaluation included calculating the drawdown time for the R-36 canal and the additional conveyance capacity provided by the additional gates.
    - The benefits of reducing time required to lower R-36 canal elevation by adding gates at WCS-162 upstream of the structure were assessed by performing a drawdown analysis. For the drawdown evaluation, the R-36 canal upstream of WCS-162 was assumed to be at the control elevation of the weir (elevation 18.3 feet NAVD88). The water level at the

canal was simulated by fully opening the existing gate with no additional flows coming into the canal. The existing condition drawdown simulation results indicates that it would take approximately 18 hours to lower the canal to elevation 15 feet.

- The canal drawdown simulation was repeated for one and two additional gates scenarios. The time required to drawdown R-36 canal will decrease to 11 hours by adding an identical gate. When 2 additional matching gates are provided, the time require to drawdown R-36 canal would decrease to 9 hours. Therefore, the total time required to drawdown R-36 canal (to elevation 15 feet) upstream of WCS-162 will be reduced by 7 and 9 hours by adding one and two additional gates respectively.

The mean annual, 5-year, and 10-year storm events were simulated using the updated existing condition model with 2014 survey information. The City's water control structure operation criteria were employed in these simulations. The gates are closed at the beginning of the simulation, and they will be fully open when Big Slough Canal stage at Tropicaire rises to Elevation 15.88 feet NAVD88.

Benefits of flood control upstream of WCS-162 during a storm event were evaluated by simulating the mean annual storm event starting at the drawdown stage levels (Elevation 15 feet NAVD88). For this evaluation, initial stages in R-36 Canal upstream of WCS-162 were set to the drawdown levels, i.e. simulated canal stages after 18 hours of drawdown simulation. The lower elevations will account for the additional available canal storage capacity upstream of WCS-162. During the lower initial condition simulation, the WCS-162 gate was assumed to be opened throughout the simulation. Model results with lowered initials were compared to the results with the normal initial stage, which is at the invert elevation (at elevation 18.29 feet NAVD88) of WCS-162 weir. Simulated results suggest that there will be no difference in peak stages in R-36 canal due to the lower initial canal stage. It should be noted that model results suggest the 50-foot wide weir at WCS-162 overtops by 2.6 feet conveying 328 cfs of peak flow across the structure during the mean annual storm event. The R-36 Canal upstream of WCS-162 holds approximately 30 acre-feet of storage capacity behind the gate, whereas more than 3,000 acre-feet of runoff volume is conveyed by the canal during the mean annual storm event. The additional available storage seems to be insignificant compared to the runoff conveyed by the canal during the storm event.

In addition, benefits of having one additional gate with the lowered R-36 canal stages upstream of WCS-162 were also evaluated. For this scenario, both gates (one existing and one additional BMP gate) were assumed to be fully opened throughout the simulation. Simulated results suggest that there will be no difference in R-36 canal max stages upstream of WCS-162 with an additional gate at the structure. As no difference in peak stages were predicted for the mean annual storm event, no other higher return period storm events (5-year and 10-year) were analyzed with additional gates.

In conclusion, providing one or two additional gates at WCS-162 will help to reduce the time required to draw down canal levels upstream of the structure. However, model results suggest that lower initial levels in R-36 canal upstream of the structure will provide no benefits in terms of reducing flooding at the upstream areas even for small storm events such as mean annual storm event. Modeling results suggest that there would be no adverse impacts downstream of WCS-162 due to the additional gate.

Price Boulevard LOS Improvements

Existing condition model results (May 2012 Governing Board approved model) predict that West Price Boulevard would intermittently flood between Locher Road and the Big Slough Canal during the 10, 25, and 100-year, 24-hour storm events. The West Price Boulevard stretch is identified as an arterial street that floods during the 100-year, 24-hour design storm event.

This arterial street is critical to stormwater emergency response since it provides access to emergency facilities such as North Port Utilities Building, North Port High School and Heron Creek Middle School. Therefore, the City of North Port requested further evaluation of the stretch of West Price Boulevard between North Biscayne Boulevard and the Big Slough Canal to provide BMP recommendations to meet the City of North Port LOS criteria. City Unified Land Development Code Chapter 18 Level of Service criteria for arterial roads states that flooding must be less than 6 inches, as measured at the outside edge of pavement in a 100-year, 24-hour design storm event.

Ardaman staff reviewed the May 2012 Governing Board approved model setup within the area of interest (AOI) to verify whether the current model adequately represents the 2014 condition. With desktop and field reconnaissance of the area, it was observed that a section of the surface and sub-surface drainage systems near the North Port High School had been recently updated. Ardaman recommended surveying the area of interest to better represent the existing condition. The survey data was provided by Van Buskirk/Fish & Associates, Inc.

Based on recent survey, stormwater runoff collected from the north and south swales of West Price Boulevard generally flows west from the North Port Utilities Building, whereas stormwater runoff from the remaining areas flows east from this location. Accumulated stormwater runoff going west from the North Port Utilities Building ultimately flows north via the Indian burial ground toward the R-32 canal. Stormwater runoff going east toward Big Slough is routed through a series of surface water features (ditches, swales and inlets) which connects to a sub-surface system along the north side of West Price Boulevard.

The May 2012 Governing Board approved model was updated using the 2014 survey provided by Van Buskirk/Fish & Associates, Inc. The revised 100-year storm event model results indicate that West Price Boulevard would not flood near the North Port High School as previously predicted. However, the stretch of West Price Boulevard north of Little Salt Spring would still flood by 0.4 feet at the crown during the 10-year storm event. Survey data indicates that road overtopping would occur at the lowest point (near the culvert crossing) at 17.3 feet NAVD88. The model predicted the 25-year and 100- year storm maximum stages at West Price Boulevard are 17.9 and 18.2 feet NAVD88 respectively.

The objective of this series of BMPs is to mitigate flooding along the stretch of West Price Boulevard near the Indian burial ground to meet the existing City of North Port LOS criteria. Five different BMP alternatives were considered.

Only the three alternatives that were determined to be effective in improving the LOS are described below:

- West Price Boulevard BMP 1- Dredging the R-24 and R-32 canals
    - This alternative would require: dredging 2,300 feet of R-24 canal and 1,800 feet of R-32 canal to add approximately 2 to 3 feet of depth; and installing one extra parallel 36-inch pipe at the existing culvert crossing, between Indian burial ground and the R-32 canal. The City is not allowed to disturb the 50-foot wide drainage right-of-way through the Indian burial ground.
    - Model results suggest that West Price Boulevard would not overtop during the 25-year storm event. In addition, this alternative would reduce flooding on some local streets (Dundee Ave, Surf Ave, and San Salvador Road) located north of R-32 canal.
    - The model predicted that the 100-year maximum stage at West Price Boulevard will be reduced from 18.2 to 17.5 feet NAVD88. West Price Boulevard would still overtop by 0.2 feet over the crown of the road at the lowest section during the 100-year storm event. However, the road would be passable per City of North Port LOS criteria. Model results also indicate that there will be no adverse impacts at downstream areas.
- West Price Boulevard BMP 2 - Raising the Road
    - This alternative would involve raising approximately 1,900 feet of West Price Boulevard to an elevation of 18.5 feet NAVD88. Survey data suggests that the lowest segment of the road, which is located at the culvert crossing, needs to be raised by 1.2 feet to reach an elevation of 18.5 feet NAVD88.
    - Model results suggest that the 100-year peak stages upstream and downstream of the culvert across West Price Boulevard would be 18.2 feet NAVD88 with this alternative. The model predicted the 100-year maximum stage at West Price Boulevard is below the recommended raised road crown elevation of 18.5 feet NAVD88. The peak stage model results suggest that there will be no adverse impacts or increase in stages upstream or downstream of the improvement for any modeled storm event.
    - Additional right-of-way requirement to raise the road and its availability should be thoroughly assessed prior to selecting this BMP alternative.
- West Price Boulevard BMP 3 - Dredging the R-32 and R-24 canals and Raising the Road
    - This alternative incorporates all of the aforementioned West Price Blvd improvements.
    - Model results suggest that the 100-year peak stage upstream of the culvert across West Price Boulevard would be 17.6 feet NAVD88 with this alternative. This alternative would require raising approximately 950 feet of West Price Boulevard to elevation 18.0 feet NAVD88. Compared to BMP 2 improvements, this alternative would reduce the required road improvement length by half at a lower elevation (6 inches lower than BMP 2). Like BMP 1 and BMP 2, the peak stage model results suggest that there will be no adverse impacts or increase in stages upstream or downstream of the road improvement.

In addition to the three previously described BMP alternatives, a few other BMPs were evaluated. However, modeling results suggest that theses BMPs would not mitigate the flooding conditions along the evaluated stretch of West Price Boulevard.

- One of the other BMPs evaluated was to install a 24-inch pipe at the south side of West Price Boulevard near the culvert that would run approximately 1,400 feet to the east and connect to the existing sub-surface system inlet. This BMP did not show any improvements since the BMP pipe is too long and there was not sufficient hydraulic gradient available to convey the necessary flow rate.
- Another BMP evaluated was to provide a 20-foot wide cut/swale that would connect the flooded area south of West Price Boulevard to the south towards the Little Salt Spring basin. 25-year storm event model results suggest that this BMP alternative would lower peak stages at West Price Boulevard only by 0.2 feet. However, the road would still flood during this event. Also, this BMP may raise environmental concerns considering that it would require diverting stormwater runoff from the road towards Little Salt Spring basin.

Conclusions

It was recommended that the City of North Port purchase the small number of habitable structures in which flooding is predicted for the 100-year event. Purchasing the affected properties may be more cost effective than implementing BMPs evaluated under the WMP project.

Status of Recommendations

The 2012 WMP project did not result in a plan for improvements.

<u>The Big Slough Flood Reduction Study (current)</u>

The Big Slough Flood Reduction Study will build upon the above prior work to advance previously developed concepts and develop original ideas to mitigate flooding. The City of North Port has also provided a list of BMP concepts for consideration. These and other concepts will be the subject of discussion between the Consultant team and City staff prior to evaluation.