Central and Southern Florida Project
Modified Water Deliveries to
Everglades National Park, Florida
8.5 Square Mile Area

Appendix C
Preliminary Engineering and Costs

Department of the Army

Jacksonville District, USACE of Engineers

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APPENDIX C

PRELIMINARY ENGINEERING AND COSTS

GENERAL

1. This appendix provides a discussion of the Preliminary Engineering and Costs for the alternatives evaluated in the GRR. The alternatives have been evaluated based on hydrology using a simulation model. The simulation model and analysis results are discussed in Appendix A – Hydrologic and Hydrogeologic Model Report. Each of the alternatives is described using the following 12 general categories as discussed below. Each of the Alternatives is described completely in the Appendix to allow for independent review of the document. Further, for comparison purposes each category is identified under each alternative even if the category is not utilized in the evaluation. The categories or subsections of the report are as follows:

A. Plan Description – This section provides a brief description of the plan as formulated for the hydrologic and hydrogeologic modeling. This section also provides information as to whether flood protection or mitigation is provided by the alternative.

B. Levees and Canals – This section describes the levee and canal design criteria including lengths, widths and volumes. It also provides general location of the facilities. For the purposes of this analysis, it was assumed that a geotextile material would be required to provide stability to the levee. In many cases this geotextile may not be required and may be eliminated during final design. Levee top width was estimated to be a minimum of 20-feet. This provides protection from overtopping affects. If it is determined during final design that a smaller cross-section is appropriate, the cost of the project will be adjusted.

It is understood that blasting of the canal has the potential for increasing seepage through the levee. Thus, flood mitigation is not provided by the levee but rather from the induced differential in head promoted by the levee-canal system. It must be noted that channel slope does not significantly impact its ability to transfer flow; rather, because of the porous nature of the limestone, flow is dependent on head gradient, not channel slope.

The internal levee is placed to minimize the impact of surface runoff on the water within the seepage canal. The Supplemental EIS, provided as part of Volume I, identifies the historic water quality problems associated with surface runoff from the area and projects future water quality impacts based on surface flow.

C. Structures – Structures described in this section are the pump stations that are required for the alternative to function.

The use of the 200-foot approach section for the pump station is similar to that which was used in the 1992 GDM. Since no site-specific geotechnical evaluations were performed, the use of an approach section is considered the safest design for this planning level effort. If, during final design and further

subsurface explorations, it is found that this approach section is not necessary, it can be eliminated.

For the purposes of this evaluation, all pump stations are considered to use Diesel Pumps. Diesel generators can be introduced to produce uninterrupted power and electric pumps can be substituted if determined appropriate during final design.

Alternatives that transfer water south to the C-111 system require a conveyance channel or pipe. For the purposes of these alternatives, a typical concrete pipe cost was used for estimating purposes. If local pre-cast vendors can provide appropriate conveyance facilities at a lower cost they will be identified and used during the final design process. Additionally, other conveyance facilities such as lined

D. Seepage Barrier – The seepage barrier is a part of Alternative No. 3. It is discussed in detail within the discussion of that alternative. It is noted that the auger-cast pile seepage wall is just one option that can be used to place the seepage barrier. Other options including constructing a grout curtain will be assessed in greater detail during the final design process.

E. Raise Roads – Raising the roads is Alternative No. 7 and will be discussed in that section. Raising the roads in-kind requires a significant volume of dirt to be brought onto the site. The possibility of using already purchased land as borrow areas will be investigated during final design. The advantage of an onsite borrow area is decreased cost of materials and the potential for use of the borrow area for water quality treatment.

F. Infrastructure – The infrastructure for each alternative consists of those facilities that are necessary to implement each alternative. For the most part, infrastructure consists primarily of the access roadway to the pump stations.

Stormwater runoff from the site typically infiltrates directly into the ground through the limestone surface aquifer. Historically, only minimal stormwater drainage

facilities have been constructed in the 8.5 SMA and none are routinely maintained by the County. Any additional infrastructure to handle local drainage that may have to be constructed will be done so at Public expense and is discussed in the Local Cost Analysis Appendix (Appendix F).

G. Real Estate Needs – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix, which outlines the methodology for the evaluation of real estate costs, has been developed and provided as Appendix D. The costs determined in the report are used where appropriate in the discussion of the costs for each alternative.

H. Operations and Maintenance Requirements – Operations and maintenance requirements for each alternative generally fall into three categories: levee and canal, structures and pumps, and ecological. Levees and canals require periodic inspection during their lifetime. Maintenance should be minimized through proper design.

Pump station operation and maintenance has been estimated to include the cost of operating the station. Additionally, as part of the annual costs, the cost of replacing the pumps at 25-years has been estimated.

Ecological operations and maintenance captures those costs associated with the management of the property, the periodic removal of nuisance species, and monitoring of water quality.

I. Permitting – Permitting considers those permits necessary to construct and operate the alternative. These permits are addressed in the SEIS and are referenced herein.

J. Construction Plan – The construction plan outlines the time that it will take to construct the facilities. For Alternatives Nos. 1, 2, 3, and 9, the property necessary for the construction of the facilities has already been acquired and thus, construction of these alternatives can commence immediately upon the

completion of the design. Other alternatives require land purchase or condemnation. The taking of the land has been estimated to occur through either the willing seller or "quick take" condemnation process. The potential for delay due to condemnation is discussed for the appropriate alternatives.

Dewatering may be required for the construction of the various facilities depending on their location and hydrologic conditions at the time of construction. It is recommended that the USACE obtain a master permit covering the general dewatering process and allow contractors to submit alternative plans during the bid process.

K. Demolition – Demolition considers the removal of structures, house pads, septic systems and other man-made features on the acquired property. Costs for this have been estimated for both removing the structure and for regrading of the area to a more natural-like contour to facilitate wetland plant recruitment.

L. Cost Estimate – An estimate of the cost of each of the alternatives has been developed. The cost tables for each of the alternatives provide a detail of the cost of each line item and a summary of costs including contingencies, design, and construction management. All of the costs of each alternative are summarized on a table which also provides annual cost estimates for each project. The capital and O+M costs for all alternatives are summarized in Tables C-3 and C-4.

The capital costs of each alternative are provided in the appropriate tables. These costs estimates are based on the valuation of the specific components that comprise each of the alternatives. The basis for these cost estimates is:

- Previous costs from the 1992 GDM updated as appropriate to account for time.
- Construction estimates from contractors and specialty firms including those used for pumps, pipelines, geotextiles, geomembranes and seepage barrier construction.
- Construction estimates from the South Florida Water Management District (SFWMD) and United States Army USACE. Of Engineers (USACE) for recent construction projects for Stormwater Treatment Areas and Pump Stations.
- Road construction costs based on recent bid documents for the area and the road construction requirements of Miami-Dade County.
- Demolition costs based on information supplied by the SFWMD for their recent land acquisition process under the Save Our Rivers program.

Construction Cost Uncertainty is included in the overall cost estimate and is based on the perceived imprecision of the cost values. In general, this value was determined to be 20 percent of construction costs. For Alternatives 4 and 5, the uncertainty has been reduced to 10 percent of construction costs, due to the limited new construction.

Land Acquisition considers the cost of the land that is needed for each alternative. This land includes that needed for the placement of the structures and required for flood mitigation.

Planning, Engineering and Design (PED) has been estimated along with construction management. For the purposes of this planning level analysis, PED and Construction Management are estimated to total 20 percent of the construction estimate (including construction uncertainty).

In addition to the base costs for the project, the annual costs have been estimated. These annual costs include:

- interest during construction
- interest cost per year over the 50-year life of the project,
- annualized replacement costs of pumps (25-year life) and roadways (25-year for asphalt, 10-year for other),
- annualized operations and maintenance including energy, labor and normal servicing of facility equipment,
- ecological operations and maintenance which includes intensive environmental management for two years, fire management for five years and continuous management for 50-years.

Where appropriate, one time or replacement costs have been annualized over the 50-year life of the project using a discount rate of 6-5/8 percent.

Ecological operations and maintenance costs are estimated based on the number of non-natural (disturbed acres) below elevation 7.0 NGVD that are being acquired. Three levels of restoration can occur for these acquired areas.

The base level is to acquire the property and remove aboveground structures. The second level considers the clearing of the properties and regrading back to natural land surface. In this level, house pads and drives are removed. The final level consists of the regrading and removal of the disturbed material so that restoration potential is enhanced. The first two levels and the majority of level three assumes that natural recruitment will occur and that only periodic exotics removal is necessary. Level three also relies on intense management of the area for two years with an additional five years of management by fire.

ALTERNATIVE NO. 1

AUTHORIZED GDM PLAN

1. Plan Description. This plan consists of a levee around the north and west perimeter of the 8.5 SMA running from the L-31 North Canal to SW 168th Street (Richmond Drive). Approximately 100 feet interior of the centerline of this perimeter levee is a collection or seepage canal. Internal to the seepage canal is an interior berm or levee. This configuration is depicted on Figure C-1. The purpose of this configuration is to allow water levels within Everglades National Park (ENP) to be raised to appropriate Modified Water Deliveries (MWD) or Natural System Model (NSM) levels. The seepage canal collects water which infiltrates through the perimeter levee to provide mitigation of potential water surface elevation changes within the 8.5 SMA. The interior levee is so positioned to impede surface water from entering the seepage canal. Based on previous work effort, surface water from the residential area can be expected to have the potential for inferior quality water when compared to that of the seepage from the ENP.

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A. Alternative No. 1 is considered to be a flood mitigation alternative. A flood mitigation alternative is one where water levels following the implementation of the alternative do not exceed those that existed prior to the implementation of the

MWD Project. Thus, the alternative does not change the existing storm water management level of service to the 8.5 SMA. Properties that currently experience water above ground surface will, following the implementation of the alternative, continue to experience the same water levels.

Based on discussions with the ENP, it is projected that a water quality treatment area will be developed north of the 8.5 SMA, adjacent to the L-31N canal system. This STA will treat water within the L-31N canal prior to its discharge to the ENP. The cost of this treatment area, which can be used for flow taken from the 8.5 SMA, is not included herein. However, the cost of providing monitoring for the discharge from the pump station has been estimated to be $500,000 per year for five years.

B. Levees and Canal. The perimeter levee has an estimated length of 40,200 feet, a top width of 20 feet and an elevation of 10.2 feet as shown on Figure C-2. The seepage canal is shown on Figure C-3 and varies in width and depth depending on the location relative to the proposed pump station S-357, located at the northeast junction of the seepage canal with canal L-31N. For Alternative No. 1, the width varies from 40 feet at the northeastern end to 15 feet at the southern end near SW 168th Street, with a variation in depth from 15 feet at the northern end to 8 feet at the southern terminus.

During the construction of the L-31N canal and in subsequent investigations, it has been found that the residential area is underlain by a thin layer of silt and peat. This thin layer of organic material is expected to pose no problems for either the construction or the stability of the levee because of its relatively shallow depth. Additionally, the Soil Survey of Dade County Area, Florida (1996) indicates that marl or limestone rock is exposed at or near the ground surface along the western and northern perimeter of the 8.5 SMA. Medium hard to hard highly permeable limestone rock is expected to be encountered from the ground surface to below the canal invert elevation.

The seepage canal is designed for the flow rates calculated by the USACE using the "MODBRANCH" model. Based on the results of the USACE analyses, a total flow rate of 500 cfs is anticipated at the northeast terminus of the seepage canal at canal L-31N. This flow rate can be equally distributed along the 40,200 feet of canal to allow sizing of the canal cross-sections for each segment shown on Figure C-1. The calculated canal sections are shown in Table C-1. A canal

bottom slope of 0.000013 ft/ft was used to calculate the canal flow rate; this is a gradient of 0.5 feet over the 40,200 feet canal length. It is understood that construction of a canal with this type of tolerance is difficult and unnecessary in the context of the base material. Rather, the slope is provided as an idealized projection of a typical slope, understanding that the blasting of rock will result in a rougher, less exacting bottom configuration. The estimated excavation volume, assuming a 20% overcut, would be 958,000 cubic yards (cy).

The canal will be formed by drilling, blasting and excavating the limestone rock. The blasting and excavation should reduce the limestone rock to a graded cobble, gravel and sand mixture. The excavated material should be suitable for the levee construction provided the material is crushed and processed; the maximum particle size of the crushed rock should be less than 2 inches.

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The levee cross-sections are shown in Figures C-2 and C-3. A woven geotextile is recommended beneath the levees to stop migration of embankment fill into the porous limestone and to distribute the embankment load if localized peat/muck deposits are encountered. A geomembrane will be required on the ENP side of the perimeter levee to reduce the seepage through the levee. Additionally, a non-woven geotextile is recommended above/below the geomembrane to reduce the potential of punctures caused by the angular processed fill material. A total levee volume of 562,700 cy is required. Therefore, there is a net export of approximately 395,300 cy. The net export material will either be used in an expanded levee, stockpiled or sold.

C. Structures. A pump station designated S-357 (Figure C-4) is to be constructed at the northeastern end of the seepage collection canal. This facility will pump water into the L-31N canal for conveyance north to an area adjacent to ENP and Northeast Shark River Slough (NESRS). The pump station has a discharge capacity of 500 cfs. The pump station will be equipped with diesel powered axial flow pumps with a design head of less than 10 feet. A conveyance channel will be required for the S-357 pump station to connect it to canal L-31N. Additionally, 200 feet of the seepage canal will be lined with concrete and training walls constructed to connect the seepage canal to the pump intake structure.

The pump station will consist of a reinforced concrete structure supporting the pumps and a reinforced concrete gated spillway, a superstructure consisting of concrete block walls and reinforced concrete rigid frames will be used to house

the pumping units. An intake structure with a bay for each pumping unit will be constructed including a trash rack and service bridge.

D. Seepage Barrier. This item is not required for this Alternative.

E. Raise Roads. This item is not required for this Alternative.

F. Infrastructure. A pump station access road will be constructed to El 10.2. This roadway will consist of a structural section of 2 inches of asphalt over 8 inches of limerock base. The road will be 20 feet wide including the shoulders. A diesel fuel storage tank will be required for the pump engines and electric utilities required for support equipment and lighting.

G. Real Estate Needs – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix outlines the methodology for the evaluation of real estate costs. The costs determined in the Appendix are used where appropriate in the discussion of the costs for each alternative.

H. O&M Requirements. O&M for the levee should consist of an annual visual inspection. A detailed inspection plan will be developed; however, at a minimum, the following should be noted during each inspection:

- Surface erosion gullies
- Excessive levee settlement
- Exposure of the geomembrane

The crushed processed canal rock material should be relatively durable and not prone to erosion. Vegetating the slopes is not necessary; some natural

vegetation may occur with time. The shallow rooted vegetation may also reduce slope erosion. Any identified problem should be corrected.

The O&M costs for the pump stations have been estimated based on information supplied by both the Jacksonville District of the USACE and the SFWMD. This cost is $229,875 per year and consists of specific operations and maintenance activities needed to insure that the generators and pumps operate as designed.

I. Permitting. The permit requirements for this plan have been identified and discussed within the SEIS located in Volume I.

J. Construction Plan. After clearing and grubbing the construction site, the basic construction sequence will consist of drilling, blasting and excavating the collection seepage canal in accordance with the canal dimensions presented in Table C-1. It is anticipated that the excavated canal surface will be relatively rough from the blasting/excavation process. The excavated material will be comprised of a graded material consisting of sand to rock size particles; relatively large pieces of rock may be generated by the blasting operation because of the relatively shallow blasting and variable limestone hardness. The canal blast rock is suitable as fill for levee construction. This material can be excavated with conventional excavating equipment. A crusher will be required to reduce the limestone rock to sand-gravel gradation with maximum particle size less than 2 inches.

The blasting operation will produce transient vibrations that will attenuate with increased distance from the blast location. The vibrations produced by blasting should be barely perceptible to humans at a distance of approximately 1-mile and distinctly perceptible at a distance of ¼ to ½ mile. For structures located within a distance of ¼ mile of the blasting operations, vibration levels should be measured, and shot charges may need to be adjusted to maintain a vibration level below a peak particle velocity of 0.5 inches per second.

The levee construction will consist of the following general construction sequence:

1. Place woven geotextile beneath levee embankment.

2. Construct interior levee and core of perimeter levee.

3. Shape levee surface.

4. Place non-woven geotextile "cushion" on upstream 3:1 (H:V) face of perimeter levee in areas where geomembrane will be placed.

5. Place non-woven geotextile above geomembrane.

6. Complete construction of perimeter levee.

Dewatering will be required for the construction of the reinforced concrete pumping station. Blasting may also be required for foundation construction and for the intake canal and discharge pool.

K. Demolition. Alternative No. 1 calls for the placement of a perimeter levee, seepage canal, and internal levee on land that is owned or is in the process of being acquired by the USACE. If not currently cleared, the property will be cleared of all structures and regraded to facilitate the placement of the required facilities. Additionally, lands purchased by the SFWMD as part of the Save Our Rivers program may need to be regraded to meet wetland creation needs. Management of the purchased lands will reduce exotic vegetation and promote viable wetland habitat.

The SFWMD will be the entity that will manage the area that is allowed to migrate to wetland conditions. These costs will include not only demolition and disposal but will also provide information on costs to manage the property for the project life. Structure removal costs have been developed from the information generated and described in the Real Estate Appendix.

L. Cost Estimate. The preliminary cost summary sheet for Alternative No. 1 is presented in Table C-2. The unit rates used to estimate the costs were obtained from the following sources:

1. Current SFWMD projects

2. Local contractors currently working on similar projects in Southern Florida

3. Equipment manufactures and supplies

As shown in Table C-2, the preliminary cost estimate for Alternative No. 1 is $30,585,531. This cost estimate includes pump station S-357. The annual cost of this alternative over the 50-year life of the project is estimated to be $2.6 Million.

In addition to the Capital Costs associated with the alternative there are costs that can be considered for replacement of components or other annual costs. Replacement costs consider the cost of replacing facilities and structures. In this alternative, replacement costs consider the replacement of the pumps at the half-way point in the 50-year life-cycle and the replacement of the asphalt roadway. Annual costs consider the operations and maintenance costs for the pump station and ecological maintenance that has to occur. Replacement cost for pumps and roadways is annualized to $35,607. Annual cost for pump station operations and maintenance is $229,875.

Annual costs for ecological maintenance assume that the area that is to be converted to wetlands is regraded to appropriate contours for natural wetland recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort expended initially. Alternative 1 considers

no restoration of wetlands. Thus, the annual costs consider only the periodic removal of nuisance species at a cost of $20,000 per year. An additional annual cost is estimated for the water quality monitoring that will occur for the first five years of the project life. This cost is annualized at $147,033. The capital and O&M costs for all alternatives are summarized on Tables C-3 and C-4.

A. Alternative Performance. Alternative No. 1 is designed to provide water surface level mitigation to the 8.5 SMA while improving the water elevations and flows within the ENP. Mitigation is provided by the alternative over most of the 8.5 SMA. A small area, immediately adjacent to L-31N does not receive mitigation. The extent of wetlands and their hydroperiod within the ENP is improved over the pre-MWD condition and thus, this alternative does allow for an improvement in the overall ENP ecological condition.

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ALTERNATIVE NO. 2

MODIFIED GDM PLAN

3. Plan Description. Alternative No. 2 is a modification to Alternative No. 1 and thus consists of most of the same elements of Alternative No. 1. The primary difference is the location of the new pump station, S-357. Alternative No. 2 calls for the water collected in the internal seepage canal to be directed to the southwest corner of the 8.5 SMA at the berm terminus with SW168th Street and discharged to the C-111 system via a 120-inch diameter pipeline. This configuration is depicted on Figure C-6. For the purposes of this analysis, discharge to the C-111 system will be to the storage areas located west of the L-31N extension. Thus, water quality treatment can be accomplished in this system.

A. As in Alternative No. 1, this plan consists of a levee around the north and west perimeter of the 8.5 SMA running from the L-31 North Canal to SW 168th Street. Approximately 100 feet interior of this perimeter levee is a collection or seepage canal as shown on Figure C-3. Internal to the seepage canal is an interior berm.

The seepage canal collects water which infiltrates through the levee to mitigate for potential increased water surface elevations within the 8.5 SMA. The interior berm is positioned to prevent surface water from entering the seepage canal. Based on previous work effort, surface water from the residential area was expected to have the potential for inferior quality water when compared to that seeping from the ENP Expansion Area.

B. Levees and Canal. The perimeter levee has an estimated length of 40,200 feet, a top width of 20 feet and an elevation of 10.2 feet as shown on Figure C-2. The seepage canal shown on Figure C-3 varies in width and depth depending on the location relative to the proposed pump station S-357, located near SW 168th Street. For Alternative No. 2, the width varies from 15 feet at the northeastern end to 40 feet at the southern end near SW 168th Street, with a variation in depth from 8 feet at the northern end to 15 feet at the southern terminus.

During the construction of the L-31N canal and in subsequent investigations, it has been found that the residential area is underlain by a thin layer of silt and peat. This thin layer of organic material is expected to pose no problems for either the construction or the stability of the levee because of its shallow depth. Additionally, the Soil Survey of Dade County Area, Florida (1996) indicates that marl or limestone rock is exposed at or near the ground surface along the western and northern perimeter of the 8.5 SMA. Medium hard to hard highly permeable limestone rock is expected to be encountered from the ground surface to below the canal invert elevation.

The seepage canal is designed for the flow rates calculated by the USACE using the "MODBRANCH" model. Based on the results of the USACE analyses, a total flow rate of 500 cfs is anticipated at the terminus of the seepage canal at SW 168th Street. This flow rate can be equally distributed along the 40,200 feet of canal to allow sizing of the canal cross-sections for each segment shown on Figure C-6. The calculated canal sections are shown in Table C-5. A canal bottom slope of 0.000013 ft/ft was used to calculate the canal flow rate; this is a gradient of 0.5 feet over the 40,200 feet canal length. It is understood that construction of a canal with this type of tolerance is difficult and unnecessary in the context of the base material. Rather, the slope is provided as an idealized projection of a typical slope, understanding that the blasting of rock will result in a rougher, less exacting bottom configuration. The estimated excavation volume, assuming a 20% overcut, would be 918,000 cy.

The canal will be formed by drilling, blasting and excavating the limestone rock. The blasting and excavation should reduce the limestone rock to a graded cobble, gravel and sand mixture. The excavated material should be suitable for the levee construction provided the material is crushed and processed; the maximum particle size of the crushed rock should be less than 2 inches.

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The levee cross-sections are shown in Figures C-2 and C-3. A woven geotextile is recommended beneath the levees to stop migration of embankment fill into the porous limestone and to distribute the embankment load if localized peat/muck deposits are encountered. A geomembrane will be required on the ENP side of the perimeter levee to reduce the seepage through the levee. Additionally, a non-woven geotextile is recommended above/below the geomembrane to reduce the potential of punctures caused by the angular processed fill material. A total levee volume of 562,700 cy is required. Therefore, there is a net export of approximately 355,000 cy. The net export material will either be used in an expanded levee, stockpiled or sold.

C. Structures. A pump station designated S-357 is to be constructed at the southeastern end of the seepage collection canal. This facility will pump water into the 120-inch diameter pipeline for conveyance south to the C-111 system. The pump station has a discharge capacity of 500 cfs and will be similar in configuration to the station used in Alternative No. 1 as shown on Figure C-4.

The pump station will be equipped with diesel powered axial flow pumps with a design head of less than 10 feet. A conveyance channel will be required for the S-357 pump station to connect it to canal
L-31N. Additionally, 200 feet of the seepage canal will be lined with concrete and training walls constructed to connect the seepage canal to the pump intake structure.

The pump stations will consist of a reinforced concrete structure supporting the pumps and a reinforced concrete gated spillway, a superstructure consisting of concrete block walls and reinforced concrete rigid frames will be used to house the pumping units. An intake structure with a bay for each pumping unit will be constructed including a trash rack and service bridge.

D. Seepage Barrier. This item is not required for this Alternative.

E. Raise Roads. This item is not required for this Alternative.

F. Infrastructure. A pump station access road will be constructed to El 10.2. This roadway will consist of a structural section of 2 inches of asphalt over 8 inches of limerock base. The road will be 20 feet wide including the shoulders. A diesel fuel storage tank will be required for the pump engines and electric utilities required for support equipment and lighting.

G. Real Estate Needs. – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix outlines the methodology for the evaluation of real estate costs. The costs determined in the Appendix are used where appropriate in the discussion of the costs for each alternative.

H. O&M Requirements. O&M for the levee should consist of an annual visual inspection. A detailed inspection plan will be developed; however, at a minimum, the following should be noted during each inspection:

- Surface erosion gullies
- Excessive levee settlement
- Exposure of the geomembrane

The crushed processed canal rock material should be relatively durable and not prone to erosion. Vegetating the slopes is not necessary; some natural vegetation may occur with time. The shallow rooted vegetation may also reduce slope erosion. Any identified problem should be corrected.

The O&M costs for the pump stations has been estimated based on information supplied by both the Jacksonville District of the USACE of Engineers and the SFWMD. This cost is $298,950 per year and consists of specific operations and

maintenance activities needed to insure that the generators and pumps operate as designed.

I. Permitting. The permit requirements for this project have been identified and discussed within the SEIS located in Volume 1.

J. Construction Plan. After clearing and grubbing the construction site, the basic construction sequence will consist of drilling, blasting and excavating the collection seepage canal in accordance with the canal dimensions presented in Table C-5. It is anticipated that the excavated canal surface will be relatively rough from the blasting/excavation process. The excavated material will be comprised of a graded material consisting of sand to rock size particles; relatively large pieces of rock may be generated by the blasting operation because of the relatively shallow blasting and variable limestone hardness. The canal blast rock is suitable as fill for levee construction. This material can be excavated with conventional excavating equipment. A crusher will be required to reduce the limestone rock to sand-gravel gradation with maximum particle size less than 2 inches.

The blasting operation will produce transient vibrations that will attenuate with increased distance from the blast location. The vibrations produced by blasting should be barely perceptible to humans at a distance of approximately 1-mile and distinctly perceptible at a distance of ¼ to ½ mile. For structures located within a distance of ¼ mile of the blasting operations, vibration levels should be measured, and shot charges may need to be adjusted to maintain a vibration level below a peak particle velocity of 0.5 inches per second.

The levee construction will consist of the following general construction sequence:

1. Place woven geotextile beneath levee embankment.

2. Construct interior levee and core of perimeter levee.

3. Shape levee surface.

4. Place non-woven geotextile "cushion" on upstream 3:1 (H:V) face of perimeter levee in areas where geomembrane will be placed.

5. Place non-woven geotextile above geomembrane.

6. Complete construction of perimeter levee.

Dewatering will be required for the construction of the reinforced concrete pumping station. Blasting may also be required for foundation construction and for the intake canal and discharge pool.

K. Demolition. Alternative No. 2 calls for the placement of a perimeter levee, seepage canal, and internal levee on land that is owned or is in the process of being acquired by the USACE. If not currently cleared, the property will be cleared of all structures and regraded to facilitate the placement of the required facilities. Additionally, lands purchased by the SFWMD as part of the Save Our Rivers Program may have to be regraded. Current practice is for the District to remove structures and other appurtenances on the property. That level of effort can be considered the minimum. This minimum level has not included regrading the area to promote natural wetland recruitment process. Therefore, the second level of management will include the regrading of the area to promote this natural wetland creation needs. A final level of effort would be the potential planting of appropriate wetland plants and the removal of exotics. A similar level of management of the purchased lands will have to occur to reduce exotic vegetation and promote viable wetland habitat.

The SFWMD will be the entity that will manage the area that is allowed to migrate to wetland conditions. These costs will include not only demolition and but will also provide information on costs to manage the property for the project life.

Structure removal costs have been developed based on the results generated and described in the Real Estate Appendix.

L. Cost Estimate. The preliminary cost summary sheet for Alternative No. 2 is presented in Table C-6. The unit rates used to estimate the costs were obtained from the following sources:

1. Current SFWMD projects.

2. Local contractors currently working on similar projects in Southern Florida.

3. Equipment manufacturers and supplies.

As shown in Table C-6, the preliminary cost estimate for Alternative No. 2 is $33,883,992. The primary difference between this cost estimate and Alternative No. 1 is the additional $2,652,101 for the 2,000 lf of 120-inch diameter pipeline. The annual cost of this alternative over the 50-year life of the project is estimated at $2.9 Million.

In addition to the Capital Costs associated with the alternative there are costs that can be considered either for replacement or as annual costs. Replacement costs consider the cost of replacing facilities and structures. In this alternative, replacement costs consider the replacement of the pumps at the half-way point in the 50-year life-cycle and the replacement of the asphalt roadway. Annual costs consider the operations and maintenance costs for the pump station and ecological maintenance that has to occur. Replacement costs for pumps and roadways are annualized to $35,607. Annual costs for pump station operations and maintenance is $298,950.

Annual costs for ecological maintenance assume that the area that is to be converted to wetlands is regraded to appropriate contours for natural wetland

recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort as initially expended. Alternative 2 considers no restoration of wetlands. Thus, the annual costs consider only the periodic removal of nuisance species at a cost of $20,000 per year. An additional annual cost is estimated for the water quality monitoring that will occur for the first five years of the project life. This cost is annualized at $147,033. The costs for this alternative are summarized on Tables C-3 and C-4.

A. Alternative Performance. Alternative No. 2 is designed to provide water surface level mitigation to the 8.5 SMA while improving the water elevations and flows within the ENP. Mitigation is provided by the alternative over most of the 8.5 SMA. A small area, immediately adjacent to L-31N does not receive mitigation. The extent of wetlands and their hydroperiod within the ENP is improved over the pre-MWD condition and thus, this alternative does allow for an improvement in the overall ENP ecological condition.

ALTERNATIVE NO. 3

DEEP SEEPAGE BARRIER PLAN

4. Plan Description. Alternative No. 3 consists of a perimeter levee around the north and west perimeter of the 8.5 SMA running from the L-31 North Canal to SW 168th Street. A seepage barrier is to be placed within the levee. This configuration is depicted on Figure C-7. The purpose of this seepage barrier is to allow water levels within Everglades National Park (ENP) to be raised as specified in MWD and NSM. The seepage barrier reduces the potential of water conveyance from ENP into the 8.5 SMA.

A. Alternative No. 3 is considered to be a flood protection alternative. By USACE definition, a flood protection alternative provides protection to the residents within

the 8.5 SMA to a 1 in 10-year flooding event. Based on the simulation of the alternative however, it was found that flood protection was not afforded by the seepage barrier for all properties within the 8.5 SMA. Those properties not afforded flood protection by the seepage barrier will be afforded protection through flowage easements.

B. Levees and Canal. The perimeter levee has an estimated length of 40,200 feet, a top width of 20 feet and an elevation of 10.2 feet as shown on Figure C-2.

During the construction of the L-31N canal and in subsequent investigations, it has been found that the residential area is underlain by a thin layer of silt and peat. This thin layer of organic material is expected to pose no problems for either the construction or the stability of the levee because of its shallow depth. Additionally, the Soil Survey of Dade County Area, Florida (1996) indicates that marl or limestone rock is exposed at or near the ground surface along the western and northern perimeter of the 8.5 SMA. Medium hard to hard highly permeable limestone rock is expected to be encountered from the ground surface to below the canal invert elevation.

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The levee cross-sections are shown in Figures C-2 and C-3. A woven geotextile is recommended beneath the levees to stop migration of embankment fill into the porous limestone and to distribute the embankment load if localized peat/muck deposits are encountered. A geomembrane will be required on the ENP side of the perimeter levee to reduce the seepage through the levee. Additionally, a non-woven geotextile is recommended above/below the geomembrane to reduce the potential of punctures caused by the angular processed fill material. A total levee volume of 562,700 cy is required. Total fill available from the excavation locally is 517,572. Therefore, there is a net import of approximately 45,145 cy. Potential borrow material is available from the
L-31N spoil banks located east of L-31N near Richmond Drive. This material should be similar in composition to the canal excavation material. It appears that there is sufficient material to complete the levee construction. Additionally, it may be more cost effective for the contractor to simply increase the canal width to generate the necessary borrow material because of the limited access along the alignment.

C. Structures. There are no flow control structures required for the implementation of the seepage barrier adjacent to the 8.5 SMA.

D. Seepage Barrier. Vertical seepage barriers are widely used as a method to reduce lateral seepage through permeable soils or rock. Installation of a seepage barrier at this location is problematic because of the presence of moderately hard to hard rock and the presence of voids and solution channels within the limestone. Conventional slurry wall construction is not practical even if the alignment is drilled and pre-blasted because of the irregular size of the blasted rock and risk of refusal of the excavation equipment in this type of material.

Deep mixing with multi-auger drilling equipment may be more appropriate for these geotechnical conditions. A system has been developed that includes pre-drilling the rock to required depth followed by in-situ mixing with either bentonite or cement to produce overlapping circular columns. This technology has been used in limestone rock to depths in excess of 100 feet. One potential concern with this method or other similar methods, is the potential loss of fluid into the voids or solution channels. Close monitoring of the volume of mixed material will be required to detect losses; however, it is very likely some losses may go undetected. Significant fluid losses can cause a fully penetrating window to occur through the in-situ wall and may render parts of the wall relatively useless to reducing seepage flow. Small openings through the wall of less than 1% of the wall area can allow substantial seepage losses.

For the purposes of this evaluation, the depth to the water retarding layer was estimated to be between 45 and 75 feet (Fish and Stewart). For the purposes of this cost estimate, the depth of the seepage barrier was estimated at 75 feet.

E. Raise Roads. This item is not required for this Alternative.

E. Infrastructure. Not required for this

G. Real Estate Needs. – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix outlines the methodology for the evaluation of real estate costs. The costs determined in the Appendix are used where appropriate in the discussion of the costs for each alternative.

H. O&M Requirements. O&M for the levee should consist of an annual visual inspection. A detailed inspection plan will be developed; however, at a minimum, the following should be noted during each inspection:

- Surface erosion gullies
- Excessive levee settlement
- Exposure of the geomembrane

The crushed processed canal rock material should be relatively durable and not prone to erosion. Vegetating the slopes is not necessary; some natural vegetation may occur with time. The shallow rooted vegetation may also reduce slope erosion. Any identified problem should be corrected.

H. Permitting. The permit requirements for this project have been identified and discussed within the SEIS located in Volume 1.

I. Construction Plan. After clearing and grubbing the construction site the levee construction will consist of the following general construction sequence:

1. Install seepage barrier along length of levee.
2. Place woven geotextile beneath levee embankment.
3. Construct interior levee and core of perimeter levee.
4. Shape levee surface.

5. Place non-woven geotextile "cushion" on upstream 3:1 (H:V) face of perimeter levee in areas where geomembrane will be placed.

6. Place non-woven geotextile above geomembrane.

7. Complete construction of perimeter levee.

Dewatering will be required for the construction of the reinforced concrete pumping station. Blasting may also be required for foundation construction and for the intake canal and discharge pool.

K. Demolition. Alternative No. 3 does not provide the flood protection called for in the performance of this alternative. Therefore, flowage easements will have to be obtained from willing owners. If flowage easements are not granted, purchase of the property not receiving flood protection or mitigation must occur. The seepage barrier and levee structure will be on land that is owned or is in the process of being acquired by the USACE. If not currently cleared, the property will be cleared of all structures and regraded to facilitate the placement of the required facilities. Additionally, lands purchased by the Water Management District as part of the Save Our Rivers Program and other lands purchased to provide flood protection may have to be regraded to meet wetland creation needs. Management of the purchased lands will have to occur to reduce exotic vegetation and promote viable wetland habitat.

The SFWMD will be the entity that will manage the area that is allowed to migrate to wetland conditions. These costs will include not only demolition and but will also provide information on costs to manage the property for the project life. Structure removal costs have been developed based on historic information provided by the SFWMD and information from the Real Estate Appendix.

L. Cost Estimate. The cost estimates for Alternative No. 3 is $241,374,100. The annual cost of this alternative over the 50-year life of the project is estimated at

$10.0 Million. The preliminary cost summary sheet for Alternative No. 3 is presented in Table C-7. The unit rates used to estimate the costs were obtained from the following sources:

1. Current SFWMD projects

2. Local contractors currently working on similar projects in Southern Florida

3. Equipment manufacturers and supplies

In addition to the Capital Costs associated with the alternative there are costs that can be considered as either replacement or as annual costs. Replacement costs consider the cost of replacing facilities and structures.

Annual costs for ecological maintenance assume that the area that is to be converted to wetlands is regraded to appropriate contours for natural wetland recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort as initially expended. Alternative 3 considers no restoration of wetlands. Thus, the annual costs consider only the periodic removal of nuisance species at a cost of $20,000 per year. An additional annual cost is estimated for the water quality monitoring that will occur for the first five years of the project life. This cost is annualized at $147,033. The costs for all alternatives are summarized on Tables C-3 and C-4.

M. Alternative Performance. Alternative No. 3 is formulated to provide flood protection to the 8.5 SMA and thus allow for the increase in stage and duration of inundation within the 8.5 SMA. The seepage barrier serves to allow water levels within the ENP to reach their highest levels. However, flood protection is not achieved. In fact, Alternative No. 3 does not even provide flood mitigation to the 8.5 SMA. Therefore, fee and easement purchase is required.

ALTERNATIVE NO. 4

LANDOWNER'S CHOICE LAND ACQUISITION PLAN

5. Plan Description. This plan is considered a non-structure plan and is depicted on Figure C-8. The residents will have three options under this alternative: direct buy-out, designation of flowage easements, and life estates with flowage easements. Site specific modeling will be required to identify the extent to which each property will be affected by increased stages to allow residents to select the option that is most desirable.

Flowage Easements is a method of allowing additional levels of inundation to occur or provide private property without direct buyout. For this option, a property owner is allowed to decide whether the increased level of flooding that may occur due to the project is deleterious. The owner can then decide to keep the property, but allow the higher levels of water to flow across his or her property. Flowage easements allow compensation to the homeowner at a slightly lower rate than full buyout.

Life Estates with flowage easements, for the purposes of this evaluation, is a voluntary process wherein an owner sells the property for the project but is allowed to remain on the property until the owner is deceased. However, the owner must allow for a flowage easement for the property to accommodate the short-term implementation of the project. Thus, a property owner, who is willing to accept the additional levels of inundation caused by the raising of water levels in the ENP can be paid for the property now but retain use of the property as long as the owner remains alive.

A. Alternative No. 4 is considered to be a flood protection alternative. By USACE definition, a flood protection alternative provides protection to the residents within the 8.5 SMA from flood stages from a 1 in 10 year flooding event. Protection is not provided by structural means such as pumps, gates, and conveyance channels. Rather, protection is provided through direct purchase, life-estates and flowage easements, and life estates with flowage easements.

B. Levee and Canals. This item is not required for this Alternative.

C. Structures. This item is not required for this Alternative.

D. Seepage Barrier. This item is not required for this Alternative.

E. Raise Roads. This item is not required for this Alternative.

F. Infrastructure. The infrastructure that will be required for this alternative is not fully developed at this time. Since, the alternative consists of the direct purchase of property, flowage easements, or life-estates with flowage easements, higher water elevations are considered a consequence of the residents selection. Thus, no pump stations, control structures or conveyance channels are projected. However, some local improvements to allow water to flow across properties are projected. The cost estimate associated with this alternative considers these costs.

G. Real Estate Needs. – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix outlines the methodology for the evaluation of real estate costs, and details the rules for implementation of the alternative. The costs determined in the Appendix are used where appropriate in the discussion of the costs for each alternative.

H. O&M Requirements. O&M of structures is not required for this alternative. However, O&M is required for wetland areas created as a result of this effort. Operations and Maintenance levels are discussed under Section K – Demolition.

I. Permitting. The permit requirements for this project has been identified and discussed within the SEIS contained in Volume I.

J. Construction Plan. A construction plan is not required for this alternative. The primary effort for this alternative is the determination as to which properties will accept which alternative. Based on the information supplied by the SFWMD there are a number of property owners who will likely be unwilling to accept any of these alternatives. For those properties, condemnation will have to occur. At this writing, condemnation authority is available to the U.S. Army Corps of Engineers for the Authorized Project. Condemnation authority for this project either will fall to the USACE if this plan becomes the Authorized Plan or would have to occur by the SFWMD. At this time, the SFWMD does not have condemnation authority but could receive it from the State Legislature. It has been estimated that obtaining condemnation authority could take up to 12-months. Following receipt of condemnation authority, it is projected that "Quick Claim" title transfers would take up to two years to occur. Finally, demolition of acquired property could be completed in less than six months, for total estimated implementation time of approximately 3.5 years or about April 2004.

K. Demolition. Alternative No. 4 calls for the creation of open space within the entirety of the 8.5 SMA with the exception of the existing FAA site. The creation of open space is necessitated due to the periodic inundation of the area that will result from the increase of surface water elevations within the ENP. Thus, those private lands that are acquired through either direct purchase or life estates with flowage easements would become public lands under this alternative. With the purchase of the property, the question of what becomes of the land then becomes a concern. Historically, the area on the eastern portion of the 8.5 SMA has been found suitable for agriculture use. The area to the west, closer to ENP is primarily vacant or open land. Since the surface water elevations within the ENP would fluctuate during the wet and dry seasons, it is reasonable to assume that, depending on climate conditions, portions of the property may be suitable for periodic agricultural use. The western portion of the area will be subject to increased surface water elevations and extended periods of inundation. The final disposition of the properties purchased for this alternative will depend on the economic viability of the potential future uses. Thus, a decision as to whether limited agriculture will be allowed on the eastern portion of the tract will have to be determined. If agriculture is allowed to exist on the 8.5 SMA, runoff from it, like other areas, will have to meet final water quality standards by 2006. Therefore, stormwater treatment will likely be required for agricultural areas.

Purchase of properties by the SFWMD as part of the Save Our Rivers Program has transferred some properties from private to public ownership. For the most part, structures that existed on the property have been razed and the demolition debris either removed or placed in low areas on the site. Most of these sites have raised areas where the former structure pads and access roads were located.

The goal of this analysis is to quantify the cost of the purchase of the property specifically as it addresses the dispensation of the existing structures and appurtenances. Three basic procedures for demolition of existing structures have been proposed. These include:

- Demolition of current structure without removal of fill pad. This option for demolition is similar in nature to what the SFWMD is currently doing with lands that it has purchased within the 8.5 SMA. The structure is razed but the fill pad and access road are left intact. Septic systems are collapsed and filled.

- Demolition of current structure, removal of fill pad and access road. This option provides for the demolition of the current structure including the removal of the fill pad, access road, and septic system. Property is regraded to approach natural (pre-development) conditions. Natural recruitment is expected to foster wetland growth.

- Demolition of current structure, removal of fill pad and access drive, exotics removal and land management. This option provides for the demolition of the current structure including the removal of the fill pad, access road, and septic system. Property is regraded to approach natural (pre-development) conditions. Exotic species are removed from the site and the area is managed to promote natural wetland development. Based on historic information, the initial work effort to remove exotics and promote natural recruitment is significant. Subsequent efforts are greatly reduced.

As can be seen by the three optional procedures for land management presented above, the level of effort can range from the minimal clearing of the site through full site management. The cost estimate provides information on the cost for demolition and regrading as a capital cost. Additionally, an annual ecological operations and maintenance cost is provided to account for initial wetland establishment and continued operations and maintenance.

For the purposes of this evaluation, it is expected that areas purchased and unsuitable for agriculture use after increased water stages are achieved, would require both structure removal and land management. The SFWMD will be the entity that will manage the area that is allowed to migrate to wetland conditions. Structure removal costs have been developed and are included in the Real Estate Appendix.

L. Cost Estimate. The preliminary cost summary sheet for Alternative No. 4 is presented in Table C-8. As shown in Table C-8, the preliminary cost estimates for Alternative No. 4 is $131,978,793. The annual cost of this alternative over the 50-year life of the project is estimated at $2.9 Million. The estimated costs for demolition and land acquisition are believed to be reasonable estimates for these items. Direct purchase of property costs have been taken from the real estate estimates. Life Estates and Flowage Easements costs were developed as a portion of the total purchase price.

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Annual costs for ecological maintenance assume that the area to be converted to wetlands is regraded to appropriate contours for natural wetland recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort as initially expended. Alternative 4 considers extensive restoration of wetlands. Thus, the annual costs include initial intensive treatment, periodic burning, and the periodic removal of nuisance species. The total annualized cost is estimated to be $106,687. No additional cost is estimated for the water quality monitoring. The costs for all alternatives are summarized on Tables C-3 and C-4.

M. Alternative Performance. Alternative No. 4 is designed to provide water surface level mitigation to the 8.5 SMA while improving the water elevations and flows within the ENP. Mitigation is provided through a landowner's choice of options as discussed above. Water surface elevations and hydroperiods within the ENP are raised significantly within the ENP. Only Alternative No. 3, discussed above, results in higher levels in the ENP.

ALTERNATIVE NO. 5

TOTAL BUY-OUT PLAN

6. Plan Description. This plan calls for the purchase of all of the property within the 8.5 SMA. Thus, this alternative can be considered a non-structural alternative. This configuration is depicted on Figure C-9. All properties within the 8.5 SMA area will be acquired by direct purchase. This will occur through the existing willing seller program and through other means of acquisition that may include condemnation and quick-take processes.

The disposition of the land for the long-term has not yet been established. In areas to the west where water elevations will greatly impact the property, existing structures and roadways will have to be removed. The regrading of the area to facilitate water flow along NESRS is appropriate. Areas located to the east, above the 7.0 contour line can be expected to have limited affects from the existing L-31N canal. These lands can either be allowed to go fallow, have facilities fully removed, or potentially leased back to agriculture interests.

A. Alternative No. 5 is considered to be a flood protection alternative. By USACE definition, a flood protection alternative provides protection to the residents within the 8.5 SMA from flood stages from a 1 in 10-year flood event. The alternative does not change the existing storm water management level of service to the 8.5 SMA. Flood protection is provided by removing the affected residents from the impacts of increased elevations within the ENP and the resultant higher flood levels in the 8.5 SMA.

B. Levee and Canals. This item is not required for this Alternative.

C. Structures. This item is not required for this Alternative.

D. Seepage Barrier. This item is not required for this Alternative.

E. Raise Roads. This item is not required for this Alternative.

F. Infrastructure. This item is not required for this Alternative.

G. Real Estate Needs. – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix outlines the methodology for the evaluation of real estate costs. The costs determined in the Appendix are used where appropriate in the discussion of the costs for each alternative.

H. O&M Requirements. Operations and Maintenance of structures is not required for this alternative, rather, O&M is required for wetland areas created as a result of this effort. Operations and Maintenance levels are discussed under Section K – Demolition.

I. Permitting. The permit requirements for this project has been identified and discussed within the SEIS in Volume 1.

J. Construction Plan. A construction plan is not required for this alternative. The primary effort for this alternative is the determination as to how the properties will be acquired. Based on the information supplied by the SFWMD there are a number of property owners who will likely be unwilling to sell their properties. For those properties, condemnation will have to occur. At this writing, condemnation authority is available to the U.S. Army Corps of Engineers only for the Authorized Project. Condemnation authority for this project either will fall to the USACE if this plan becomes the Authorized Plan or would have to occur by the SFWMD. At this time, the SFWMD does not have condemnation authority but could receive it from the State Legislature. It has been estimated that obtaining condemnation authority could take up to 12-months. Following receipt of condemnation authority, it is projected that "Quick Claim" title transfers would take up to two years to occur. Finally, demolition of acquired property could be completed in less than six months, for total estimated implementation time of approximately 3.5 years or about April 2004.

K. Demolition. Alternative No. 5 is similar to Alternative No. 4 in that it calls for the creation of open space within the entirety of the 8.5 SMA with the exception of the existing FAA site. The creation of open space is necessitated due to the periodic inundation of the area that will result from the increase of surface water

elevations within the ENP. Thus, all private lands would become public lands under this alternative. With the purchase of the property, the question of what becomes of the land then becomes a concern. Historically, the area on the eastern portion of the 8.5 SMA has been found suitable for agriculture usage. The area to the west, closer to ENP is primarily vacant or open land. Since the surface water elevations within the ENP would fluctuate during the wet and dry seasons, it is reasonable to assume that, depending on climate conditions, portions of the property may be suitable for periodic agricultural usage. The western portion of the area will be subject to increased surface water elevations and extended periods of inundation. The final disposition of the properties purchased for this alternative will depend on the economic viability of the potential future uses. Thus, a decision as to whether limited agriculture will be allowed on the eastern portion of the tract will have to be determined.

Purchase of property by the SFWMD as part of a previous locally preferred plan (total buyout) has transferred some properties from private to public ownership. For the most part, structures that existed on the property have been razed and the demolition debris either removed or placed in low areas on the site. Most of these sites have raised areas where the former structure pads and access roads were located.

The goal of this analysis is to quantify the cost of the purchase of the property specifically as it addresses the dispensation of the existing structures and appurtenances. Three basic procedures for demolition of existing structures have been proposed. These include:

- Demolition of current structure without removal of fill pad. This option for demolition is similar in nature to what SFWMD is currently doing with lands that it has purchased within the 8.5 SMA. The structure is razed but the fill pad and access road are left intact. Septic systems are collapsed and filled.

- Demolition of current structure, removal of fill pad and access drive. This option provides for the demolition of the current structure including the removal of the fill pad, access road, and septic system. Property is regraded to approach natural (pre-development) conditions. Natural recruitment is expected to foster wetland growth.

- Demolition of current structure, removal of fill pad, access drive, exotics removal and land management. This option provides for the demolition of the current structure including the removal of the fill pad, access road, septic system. Property is regraded to approach natural (pre-development) conditions. Exotic species are removed from the site and the area is managed to promote natural wetland development.

As can be seen by the three optional procedures for land management presented above, the level of effort can range from the minimal clearing of the site through full site management.

For the purposes of this evaluation, it is expected that areas unsuitable for agriculture use after increased water stages are achieved, would require both structure removal and land management. The SFWMD will be the entity that will manage the area that is allowed to migrate to wetland conditions. These costs will include not only demolition and disposal will also provide information on costs to manage the property for the project life. Structure removal costs have been developed based on information obtained during the real estate work effort and information supplied by the SFWMD.

L. Cost Estimate. The preliminary cost summary sheet for Alternative No. 5 is presented in Table C-9. The cost estimates for Alternative No. 5 is $179,068,989.

Annual costs for ecological maintenance assume that the area to be converted to wetlands is regraded to appropriate contours for natural wetland recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort as initially expended. Alternative No. 5 considers extensive restoration of wetlands. Thus, the annual costs include initial intensive treatment, periodic burning, and the periodic removal of nuisance species. The total annualized cost is estimated to be $106,687. No additional cost is estimated for

the water quality monitoring. The costs for all alternatives are summarized on Tables C-3 and C-4.

M. Alternative Performance. Alternative No. 5 is similar to Alternative No. 4 in its method for reaching flood mitigation. Like Alternative No. 4, Alternative No. 5 allows water levels in the ENP to be raised significantly. Mitigation is provided by the purchase of all of the property within the 8.5 SMA.

ALTERNATIVE NO. 6

WESTERN AREA AS BUFFER PLAN

7. Plan Description. This plan consists of a perimeter levee which bisects the existing 8.5 SMA at approximately the location of SW 202nd Street and the topographic elevation of 7.0-feet NGVD. Areas to the west of this main levee would be purchased. Areas to the east of this the interior levee, shown in Figure C-10, would be allowed to remain in their current land use. The perimeter levee will run generally to the west from a location just south of existing structure G-211, run south around the FAA tract, and then south along SW 202nd Avenue. The terminus of this perimeter levee would be at a topographic high located at Richmond Drive (SW 168th Street). Approximately 200 feet interior of this perimeter levee is an interior berm. The purpose of this interior levee is to assure that seepage does not enter the western portion of the area.

A. Between the levees will be a seepage collection canal as shown on Figure C-3. The seepage canal is designed to keep the groundwater levels within this eastern portion of the area satisfactory for agriculture purposes. The purpose of this configuration is to allow water levels within Everglades National Park (ENP) to be raised as specified in MWD or NSM levels. The seepage canal collects water which infiltrates through the levee to prevent deleterious changes on the water surface elevation within the 8.5 SMA. The interior levee is positioned to prevent surface water from entering the seepage canal. Based on previous work effort, surface water from the residential area was expected to have the potential for inferior quality water when compared to that seeping from ENP Expansion Area.

A pipeline is projected to convey seepage water from the 8.5 SMA to the C-111 system. Specifically, the water will be directed to the western storage areas proposed between the Seepage Canal and the ENP. These storage areas may provide treatment for the conveyed water. If in the event that treatment cannot occur in the facilities, an STA can be constructed south of the 8.5 SMA in areas already purchased. The costs of this treatment facility can be estimated during final design.

B. Levees and Canal. The perimeter levee has an estimated length of 25,130 feet, a top width of 20 feet and an elevation of 10.2 feet as shown on Figure C-2. The seepage canal shown on Figure C-3 varies in width and depth depending on the location relative to the proposed pump station S-357, located at the junction with SW 168th Street. For Alternative No. 6, the width varies from 15 feet at the northeastern end to 40 feet at the southern end near SW 168th Street, with a variation in depth from 8 feet at the northern end to 15 feet at the southern terminus. The interior levee is 20,445 feet long and will parallel the seepage canal.

During the construction of the L-31N canal and in subsequent investigations, it has been found that the residential area is underlain by a thin layer of silt and peat. This thin layer of organic material is expected to pose no problems for either the construction or the stability of the levee because of its relatively shallow depth. Additionally, the Soil Survey of Dade County Area, Florida (1996) indicates that marl or limestone rock is exposed at or near the ground surface along the western and northern perimeter of the 8.5 SMA. Medium hard to hard highly permeable limestone rock is expected to be encountered from the ground surface to below the canal invert elevation.

The seepage canal is designed for the flow rates calculated by the USACE using the "MODBRANCH" model. Based on the results of the USACE analyses, a total flow rate of 500 cfs is anticipated at the terminus of the seepage canal at SW 168th Street. This flow rate can be equally distributed along the 20,445 feet of canal to allow sizing of the canal cross-sections for each segment shown on Figure C-10. The calculated canal sections are shown in Table C-10. A canal bottom slope of 0.000015 ft/ft was used to calculate the canal flow rate; this is a gradient of 0.25 feet over the canal length. The estimated excavation volume, assuming a 20% overcut, would be 554,128 cubic yards cy.

The canal will be formed by drilling, blasting and excavating the limestone rock. The blasting and excavation should reduce the limestone rock to a graded cobble, gravel and sand mixture. The excavated material should be suitable for the levee construction provided the material is crushed and processed; the maximum particle size of the crushed rock should be less than 2 inches.

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The levee cross-sections are shown in Figures C-2 and C-3. A woven geotextile is recommended beneath the levees to stop migration of embankment fill into the porous limestone and to distribute the embankment load if localized peat/muck deposits are encountered. A geomembrane will be required on the ENP side of the perimeter levee to reduce the seepage through the levee. Additionally, a non-woven geotextile is recommended above/below the geomembrane to reduce the potential of punctures caused by the angular processed fill material. A total levee volume of 338,300 cy is required. Therefore, there is a net export of approximately 215,840 cy. The net export material will either be used in an expanded levee, stockpiled or sold.

C. Structures. A pump station designated S-357 is to be constructed at the southern end of the seepage collection canal. This facility will pump water into the 120-inch diameter pipeline for conveyance south to the C-111 system. The pump station will have a discharge capacity of 500 cfs. The pump stations will be equipped with diesel powered axial flow pumps with a design head of less than 10 feet. Additionally, 200 feet of the seepage canal will be lined with concrete and training walls constructed to connect the seepage canal to the pump intake structure.

The pump station will consist of a reinforced concrete structure supporting the pumps and a reinforced concrete gated spillway, a superstructure consisting of concrete block walls and reinforced concrete rigid frames will be used to house the pumping units. An intake structure with a bay for each pumping unit will be constructed including a trash rack and service bridge.

D. Seepage Barrier. This item is not required for this Alternative.

E. Raise Roads. This item is not required for this Alternative.

F. Infrastructure. A pump station access road will be constructed to El 10.2. This roadway will consist of a structural section of 2 inches AC over 8 inches of limerock base. The road will be 20 feet wide including the shoulders. A diesel fuel storage tank will be required for the pump engines and electric utilities required for support equipment and lighting.

G. Real Estate Needs. – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix outlines the methodology for the evaluation of real estate costs. The costs determined in the Appendix are used where appropriate in the discussion of the costs for each alternative.

H. O&M Requirements. O&M for the levee should consist of an annual visual inspection. A detailed inspection plan will be developed; however, at a minimum, the following should be noted during each inspection:

- Surface erosion gullies
- Excessive levee settlement
- Exposure of the geomembrane

The crushed processed canal rock material should be relatively durable and not prone to erosion. Vegetating the slopes is not necessary; some natural vegetation may occur with time. The shallow rooted vegetation may also reduce slope erosion. Any identified problem should be corrected.

The O&M costs for the pump station has been estimated based on information supplied by both the USACE and SFWMD. This cost is $298,950 per year and consists of specific operations and maintenance activities needed to insure that the generators and pumps operate as designed.

I. Permitting – Permitting considers those permits necessary to construct and operate the alternative. These permits are addressed in the SEIS and are referenced herein.

J. Construction Plan. After clearing and grubbing the construction site, the basic construction sequence will consist of drilling, blasting and excavating the collection seepage canal in accordance with the canal dimensions presented in Table C-10. It is anticipated that the excavated canal surface will be relatively rough from the blasting/excavation process. The excavated material will be comprised of a graded material consisting of sand to rock size particles; relatively large pieces of rock may be generated by the blasting operation because of the relatively shallow blasting and variable limestone hardness. A crusher will be required to process the blast rock to produce the levee fill material. The rock should be crushed to a maximum particle size of 2 inches.

The blasting operation will produce transient vibrations that will attenuate with increased distance from the blast location. The vibrations produced by blasting should be barely perceptible to humans at a distance of approximately 1-mile and distinctly perceptible at a distance of ¼ to ½ mile. For structures located within a distance of ¼ mile of the blasting operations, vibration levels should be measured, and shot charges may need to be adjusted to maintain a vibration level below a peak particle velocity of 0.5 inches per second.

The canal blast rock is suitable as fill for levee construction. This material can be excavated with conventional excavating equipment. A crusher will be required to reduce the limestone rock to sand-gravel gradation with maximum particle size less than 2 inches.

The levee construction will consist of the following general construction sequence:

1. Place woven geotextile beneath levee embankment.

2. Construct interior levee and core of perimeter levee.

3. Shape levee surface.

4. Place non-woven geotextile "cushion" on upstream 3:1 (H:V) face of perimeter levee in areas where geomembrane will be placed.

5. Place non-woven geotextile above geomembrane.

6. Complete construction of perimeter levee.

Dewatering will be required for the construction of the reinforced concrete pumping station. Blasting may also be required for foundation construction and for the intake canal and discharge pool.

K. Demolition. Alternative No. 6 also calls for the creation of open space within a large portion of the 8.5 SMA area. The creation of open space is necessitated due to the periodic inundation of the area that will result from the increase of surface water elevations within the ENP. Thus, those private lands generally to the west of the perimeter levee would become public lands under this alternative. With the purchase of the property, the question of what becomes of the land then becomes a concern. Historically, the area on the eastern portion of the 8.5 SMA has been found suitable for agriculture usage. The area to the west, closer to the ENP is primarily vacant or open land. This alternative provides flood protection of the portion of land east of the perimeter levee. Therefore, it is expected that this land will be developed in accordance to the estimates in the Social Impact Assessment and Local Cost Analysis identified as Appendices E and F, respectively. The western portion of the area will be subject to increased surface water elevations and extended periods of inundation. The final disposition of the properties purchased for this alternative will depend on the economic viability of potential future uses.

Purchases by the SFWMD, as part of a previous locally preferred plan (total buyout), has transferred some properties from private to public ownership. For the most part, structures that existed on the property have been razed and the demolition debris either removed or placed in low areas on the site. Most of these sites have raised areas where the former structure pads and access roads were located.

The goal of this analysis is to quantify the cost of the purchase of the property specifically as it addresses the dispensation of the existing structures and appurtenances. Three basic procedures for demolition of existing structures have been proposed. These include:

- Demolition of current structure without removal of fill pad. This option for demolition is similar in nature to what the Water Management District is currently doing with lands that it has purchased within the 8.5 SMA. The structure is razed but the fill pad and access road are left intact. Septic systems are collapsed and filled.

- Demolition of current structure, removal of fill pad and access drive. This option provides for the demolition of the current structure including the removal of the fill pad, access road, and septic system. Property is regraded to approach natural (pre-development) conditions. Natural recruitment is expected to foster wetland growth.

- Demolition of current structure, removal of fill pad, access drive, exotics removal and land management. This option provides for the demolition of the current structure including the removal of the fill pad, access road, and septic system. Property is regraded to approach natural (pre-development) conditions. Exotic species are removed from the site and the area is managed to promote natural wetland development.

As can be seen by the three optional procedures for land management presented above, the level of effort can range from the minimal clearing of the site through full site management.

For the purposes of this evaluation, it is expected that areas to the west of the perimeter levee would require both structure removal and land management. The SFWMD will be the entity that will manage the area that is allowed to migrate to

wetland conditions. These costs will include not only demolition and disposal, but will also provide information on costs to manage the property for the project life.

L. Cost Estimate. The preliminary cost summary sheet for Alternative No. 6 is presented in Table C-11. The cost estimate for Alternative No. 6 is $143,852,880.

In addition to the Capital Costs associated with the alternative there are costs that can be considered either replace or annual costs. Replacement costs consider the cost of replacing facilities and structures. In this alternative, replacement costs consider the replacement of the pumps at the half-way point in the 50-year life-cycle and the replacement of the asphalt roadway. Annual costs consider the operations and maintenance costs for the pump station and ecological maintenance that has to occur. Replacement costs for pumps and roadways is annualized to $35,607. Annual cost for pump station operations and maintenance is $298,950.

Annual costs for ecological maintenance assume that the to be converted to wetlands is regraded to appropriate contours for natural wetland recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort as initially expended. Alternative 6 considers extensive restoration of wetlands. Thus, the annual costs include initial intensive treatment, periodic burning, and the periodic removal of nuisance species. The total annualized cost is estimated to be $105,315. The annual costs for water quality monitoring are estimated to be approximately $147,033. The costs for this alternative are summarized on Tables C-3 and C-4.

M. Alternative Performance. Alternative No. 6 is designed to provide flood protection for the area east of the levee. Simulation results show that this alternative fully protects this area. Water levels within the ENP are raised significantly.

ALTERNATIVE NO. 7

RAISE ALL ROADS PLAN

8. Plan Description. Alternative No. 7 was developed in response to residents comments during the Scoping Process. The residents stated that their primary need was for the raising of roads to permit them access to their property during times of high water. This alternative assumes that most of the structures within the area are already above flood levels. Raising the roads for the area consists of construction of in-kind roadways above the 1 in 10 - year flood elevation. This configuration is depicted on Figure C-11. A cross section of both the dirt and paved roads is shown on Figure C-12. In-kind replacement means that if a road is currently constructed of asphalt it will be replaced with similar construction materials. If an existing roadway is dirt, it will be reconstructed in a similar manner. Internal drainage and seepage would be managed using flowage easements, culverts and other conveyance structures. Internal drainage would be routed to L-31N to reduce the potential for conveyance of surface water carrying potential pollutants to the ENP. Internal drainage features required to facilitate surface flow are discussed in the Local Cost Analysis Appendix.

A. Alternative No. 7 is considered to be a flood mitigation alternative. By USACE definition, a flood mitigation alternative provides limits damages to the residents within the 8.5 SMA from flood stages no greater than currently exist without project implementation. Thus, the alternative does not change the existing storm water management level of service to the 8.5 SMA.

B. Levee and Canals. This item is not required for this Alternative.

C. Structures. This item is not required for this Alternative.

D. Seepage Barrier. This item is not required for this Alternative.

E. Raise Roads. According to the 8.5 Square Mile Area Study Committee Report to former Governor Lawton Chiles, dated April 1995, there are 55 miles of road located in the 8.5 SMA. Of this 55 miles, 49.7 miles are dirt roads and 5.3 miles are paved roads.

The 49.7 miles of dirt roads will be raised to elevation 10.2 NGVD. For purposes of construction cost estimating, it was assumed that the average elevation of the existing roads is 7.0 NGVD. Therefore, the roads will need to be raised an average of 3.2 feet. It was further assumed that the existing dirt roads are 24 feet wide with two 10-foot lanes and 2-foot shoulders.

Based on these assumptions, approximately 1,265,895 cy of fill is required. This fill will need to be imported. If the existing material along L-31N were utilized, this material would need to be crushed and processed.

The 5.3 miles of asphalt roadway also would be stabilized with Type B stabilization before placing the fill. Approximately 171,934 cy of fill and 75,000 sy of stabilization would be required. The roadway structural section would consist of 2 inches of asphaltic concrete over 8 inches of limerock base material.

Drainage structures will be required beneath the roadways to facilitate water movement from the ENP and storm water within the 8.5 SMA. These structures would consist of concrete culverts with drop inlets on either side of the roadway. Desilting basins would be required to connect the drainage swales to the drainage structures to reduce sediment buildup in the pipes. One structure would be required for every 1,000 feet of roadway for a total of 290 structures.

F. Infrastructure. No additional infrastructure other than raising the roads is expected for this alternative.

G. Real Estate Needs. The vast majority of roadways within the 8.5 SMA have been constructed of dirt. These roadways exist along the property lines. Miami - Dade County has not accepted the right-of-way for these roadways and thus, any raising of the roads will require the purchase of easements. The Real Estate Appendix has quantified the cost of the easements for the raising of all the roadways.

H. O&M Requirements. Roadway maintenance will be required. It is estimated that minor regrading of dirt roadways will be required every 6 months. For the

main asphalt roadways, resurfacing should be anticipated every 10 years; annual maintenance would include crack filling and patching. Annual to biannual inspection/clearing of the drainage culverts will be required to confirm that excess sediment build-up is not occurring.

I. Permitting. Permitting considers those permits necessary to construct and operate the alternative. These permits are addressed in the SEIS and are referenced herein.

J. Construction. Roadway construction will consist of compaction of the Type B stabilized subgrade to 98% standard proctor relative compaction. The Type B stabilization shall have a Limerock Bearing Ratio (LBR) of at least 40. Roadway fill shall also be compacted to 98% standard proctor. For the asphalt paved roadways, the limerock base material shall also be compacted to 98% and have a LBR of at least 100. The asphaltic concrete shall be FDOT approved Type S.

The drainage culverts will be constructed prior to roadway construction. The drainage pipes will have at least 2-feet of cover. The pipe size required for the cross-drains has been estimated to be 24-inch diameter. Actual pipe locations, size and inlet spacing will be determined during the final design for this alternative.

K. Demolition. Alternative No. 7 consists of the raising of roadways within the 8.5 SMA in-kind. That is, existing dirt roads will be raised as dirt roads and existing paved roads will be raised as paved roads. Demolition will consist only of those properties already purchased by the USACE or the SFWMD.

L. Cost Estimate. The preliminary cost summary sheet for Alternative No. 7 is presented in Table C-12. The preliminary cost estimates for Alternative No. 7 is $136,001,034.

In addition to the Capital Costs associated with the Alternative there are costs that can be considered either to be replacement or annual costs. Replacement costs consider the cost of replacing facilities and structures. In this alternative,

replacement costs consider the replacement of the pumps at the half-way point in the 50-year life-cycle and the replacement of the asphalt roadway. Annual costs consider the operations and maintenance costs for the pump station and ecological. Replacement costs for pumps and roadways is annualized to $432,426.

Annual costs for ecological maintenance assume that the area to be converted to wetlands is regraded to appropriate contours for natural wetland recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort as initially expended. Alternative 7 considers extensive restoration of wetlands. Thus, the annual costs include initial intensive treatment, periodic burning, and the periodic removal of nuisance species. The total annualized cost is estimated to be $106,687. No additional cost is estimated for the water quality monitoring, as there is no collection, conveyance or pumping facility in this alternative. The costs for all alternatives are summarized on Tables C-3 and C-4.

M. Alternative Performance. Alternative No. 7 is designed to provide water surface level mitigation to the 8.5 SMA while improving the water elevations and flows within the ENP. Mitigation is provided by the raising of all roadways within the 8.5 SMA to a level that is above the 1 in 10 year flood level. The simulations show that water levels in the ENP are significantly increased by the implementation of this alternative. However, since the water levels in the 8.5 SMA are also raised significantly, properties and flowage easements must also be obtained. Additionally, raising the roadways in-kind forces brings up the issue of continued maintenance. For the purposes of this evaluation, it was anticipated that asphalt roads would have a replacement life of 25 years. Dirt roads would have to be replace, regraded, or reshaped often; potentially after each wet season or significant storm. Additionally, the cross drains that are placed within the 8.5 SMA to allow flow will likely be subject to a significant silt loading and thus require additional maintenance.

ALTERNATIVE NO. 8

WESTERN AREA AS FLOW-WAY PLAN

9. Plan Description. This plan consists of a flow-way bounded by perimeter and interior levees as shown on Figure C-13. The flow-way sweeps from the northeast of the 8.5 SMA at canal L-31N to the southwest near the junction of SW 209th and 212th Streets and Richmond Drive. The flow-way generally follows the 7.0 feet NGVD elevation contour. Areas to the west of the interior levee would be purchased. Areas to the east of the interior levee would be allowed to remain in their current land use. The purpose of the containment levees is to channel flow through the western portion of the 8.5 SMA and to discharge water to the C-111 area. The flow-way between the levees is a shallow swale with an elevation of 6.0 feet. This configuration is shown in Figure C-12.

There is no internal seepage collection canal proposed for this alternative. A new pump facility planned for the area is designated as S-357. This pump facility is located at SW168th Street west of the interior levee, at the terminus of the flow-way. The purpose of this facility is to transfer water from within the flow-way to the C-111 project area.

The perimeter levee has a length of 24,860 feet, a top width of 20 feet and an elevation of 10.2 feet as developed in the GDM. The perimeter levee is shown on Figure C-2.

A. Alternative No. 8 is a flood mitigation alternative. By definition, the areas located east of the flow-way should not experience any increase in flood stages above that which existed prior to the implementation of the MWD project. This alternative does not change the existing level of storm water management to the eastern area. Properties that currently experience water above the ground surface will continue to experience the same levels.

The flow-way is to be a shallow swale-like facility wherein flows would be allowed to spread across a relatively shallow pool area. The relatively slow velocity of the water as well as the natural vegetation that will comprise the swale bottom will aid in the treatment of water from the site. Additionally, this alternative calls for the use of a "spreader swale" south of Richmond Drive to allow water to flow south to the C-111 system, ostensibly along the surface. This surface flow would provide additional treatment.

B. Levees and Swale. The perimeter levee has an estimated length of 24,860 feet, a top width of 20 feet and an elevation of 10.2 feet as shown on Figure C-2 and the interior levee is 21,700 feet in length. The swale will be formed by grading a "V" shaped ditch with a cut of about 0.5 to 1-foot midway between the two levees. The swale will be about 1,000 feet wide and this material will be used as the levee fill.

During the construction of the L-31N canal and in subsequent investigations, it has been found that the residential area is underlain by a thin layer of silt and peat. This thin layer of organic material is expected to pose no problems for either the construction or the stability of the levee because of its relatively shallow depth. Additionally, the Soil Survey of Dade County Area, Florida (1996) indicates that marl or limestone rock is exposed at or near the ground surface along the western and northern perimeter of the 8.5 SMA. Relatively soft marl and limestone rock is expected to be encountered from the ground surface to a depth of 1 ft.

The swale will be formed with conventional earthmoving equipment. The excavated material (excluding organic matter) should be suitable for the levee construction.

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The levee cross-sections are shown in Figures C-2 and C-3. A woven geotextile is recommended beneath the levees to stop migration of embankment fill into the porous limestone and to distribute the embankment load if localized peat/muck deposits are encountered. A geomembrane will be required on the ENP side of the perimeter levee to reduce the seepage through the levee. Additionally, a non-woven geotextile is recommended above/below the geomembrane to reduce the potential of punctures caused by the angular processed fill material. A total levee volume of 339,000 cy is required; the swale width will be adjusted as needed to generate the necessary quantity of levee fill material.

C. Structures. A pump station designated S-357 is to be constructed at the southern end of the swale. This facility will pump water into a spreader swale and channel south of Richmond Drive. The pump station will have a discharge capacity of 500 (cfs). The pump station will be equipped with diesel powered axial flow pumps with a design head of less than 10 ft.

The pump station will consist of a reinforced concrete structure supporting the pumps and a reinforced concrete gated spillway, a superstructure consisting of concrete block walls and reinforced concrete rigid frames will be used to house the pumping units. An intake structure with a bay for each pumping unit will be constructed including a trash rack and service bridge.

D. Seepage Barrier. This item is not required for this Alternative.

E. Raise Roads. This item is not required for this Alternative.

F. Infrastructure. A pump station access road will be constructed to Elevation 10.2. This roadway will consist of a structural section of 2 inches AC over 8 inches of limerock base. The road will be 20 ft. wide with shoulders. A diesel fuel storage tank will be required for the pump engines and electric utilities required for support equipment and lighting.

G. Real Estate Needs. – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix outlines the methodology for the evaluation of real estate costs. The costs determined in the Appendix are used where appropriate in the discussion of the costs for each alternative.

H. O&M Requirements. O&M for the levees should consist of an annual visual inspection. A detailed inspection plan will be developed; however, at a minimum, the following should be noted during each inspection:

- Surface erosion gullies
- Excessive levee settlement, and
- Exposure of the geomembrane.

Vegetating the slopes will be necessary because the surficial soil and weathered rock that will be used as fill are not as durable as the canal excavation material discussed in Alternatives 1, 2, 3, 6 and 9. Any identified problem should be corrected.

The O&M cost for the pump station has been estimated based on information supplied by both the USACE and SFWMD. This cost is $298,950 per year and consists of specific operations and maintenance activities needed to insure that the generators and pumps operate as designed.

I. Permitting – Permitting considers those permits necessary to construct and operate the alternative. These permits are addressed in the SEIS and are referenced herein.

J. Construction Plan. After clearing and grubbing the construction site, the basic construction sequence will consist of grading the swale with conventional earthmoving equipment. The swale cut material is suitable as fill for levee construction provided the organic material is removed.

The levee construction will consist of the following general construction sequence:

1. Place woven geotextile beneath levee embankment.

2. Construct interior levee and core of perimeter levee.

3. Shape levee surface.

4. Place non-woven geotextile "cushion" on upstream 3:1 (H:V) face of perimeter levee in areas where geomembrane will be placed.

5. Place non-woven geotextile above geomembrane.

6. Complete construction of perimeter levee.

Dewatering will be required for the construction of the reinforced concrete pumping station. Blasting may also be required for foundation construction and for the intake canal.

K. Demolition. Alternative No. 8 calls for the creation of open space and floodway within the western portion of the 8.5 SMA area. The creation of open space and floodway is necessitated due to the inundation of the area that will result from the increase of surface water elevations within the ENP. Thus, those private lands generally to the west of the internal levee would become public lands under this alternative. With the purchase of the property, the question of what becomes of the land becomes a concern. Historically, the area on the eastern portion of the 8.5 SMA has been found suitable for agriculture usage. The area to the west, closer to the ENP expansion area is primarily vacant or open land. Since the surface water elevations within the ENP would fluctuate during the wet and dry seasons, it is reasonable to assume that, depending on climate conditions, portions of the property may be suitable for periodic agricultural usage. The western portion of the area will be subject to increased surface water elevations and extended periods of inundation. The final disposition of the properties purchased for this alternative will depend on the economic viability of the potential future uses.

Purchase of properties by the SFWMD as part of a previous locally preferred plan (total buyout) has transferred some properties from private to public ownership. For the most part, structures that existed on the property have been razed and the demolition debris either removed or placed in low areas on the site. Most of these sites have raised areas where the former structure pads, and access roads were located.

The goal of this analysis is to quantify the cost of the purchase of the property specifically as it addresses the dispensation of the existing structures and

appurtenances. Three basic procedures for demolition of existing structures have been proposed. These include:

- Demolition of current structure without removal of fill pad. This option for demolition is similar in nature to what SFWMD is currently doing with lands that it has purchased within the 8.5 SMA. The structure is razed but the fill pad and access road are left intact. Septic systems are collapsed and filled.

- Demolition of current structure, removal of fill pad and access drive. This option provides for the demolition of the current structure including the removal of the fill pad, access road, and septic system. Property is regraded to approach natural (pre-development) conditions. Natural recruitment is expected to foster wetland growth.

- Demolition of current structure, removal of fill pad, access road, exotics removal and land management. This option provides for the demolition of the current structure including the removal of the fill pad and access road. The septic system is removed. Property is regraded to approach natural (pre-development) conditions. Exotic species are removed from the site and the area is managed to promote natural wetland development.

As can be seen by the three optional procedures for land management presented above, the level of effort can range from the minimal clearing of the site through full site management.

For the purposes of this evaluation, it is expected that areas to the west of the internal levee would require both structure removal and land management. The SFWMD will be the entity that will manage the area that is allowed to migrate to wetland conditions. These costs will include not only demolition and disposal but will also provide information on costs to manage the property for the project life. Structure removal costs have been developed and are included in the Real Estate Appendix.

L. Cost Estimate. The preliminary cost estimates for Alternative No. 8 is $142,189,819. The preliminary cost summary sheet for Alternative No. 8 is presented in Table C-13. The unit rates used to estimate the costs were obtained from the following sources:

1. Current SFWMD projects

2. Local contractors currently working on similar projects in Southern Florida

3. Equipment manufactures and suppliers

In addition to the Capital Costs associated with the Alternative there are costs that can be considered to be either replacement or annual costs. Replacement costs consider the cost of replacing facilities and structures. In this alternative, replacement costs consider the replacement of the pumps at the half-way point in the 50-year life-cycle and the replacement of the asphalt roadway. Annual costs consider the operations and maintenance costs for the pump station and ecological maintenance that has to occur. Replacement costs for pumps and roadways is annualized to $35,607. Annual costs for pump station operations and maintenance is $298,950.

Annual costs for ecological maintenance assume that the area to be converted to wetlands is regraded to appropriate contours for natural wetland recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort as initially expended. Alternative No. 8 considers limited restoration of wetlands. The annual costs include initial intensive treatment, periodic burning, and the periodic removal of nuisance species. The total annualized cost is estimated to be $46,463. Water quality monitoring for the discharge from the pumping station is estimated at $147,033 per year. The costs for this alternative are summarized on Tables C-3 and C-4.

M. Alternative Performance. Alternative No. 8 is designed to provide water surface level mitigation to the 8.5 SMA while improving the water elevations and flows within the ENP. Mitigation does not occur over most of the 8.5 SMA and thus, the purchase of easement to allow flow is a requirement. The extent of wetlands and their hydroperiod within the ENP is improved over the pre-MWD condition and thus, this alternative does allow for an improvement in the overall ENP ecological condition.

ALTERNATIVE NO. 9

ADAPTIVE REFINEMENT OF GDM PLAN

10. Plan Description. Alternative No. 9 is a combination of Alternative No. 1 and Alternative No. 2 and has very similar structural features. This plan consists of a levee around the north and west perimeter of the 8.5 SMA running from the L-31 North Canal to SW 168th Street. Approximately 100 feet interior of this perimeter levee is a collection or seepage canal. Internal to the seepage canal is an interior berm. This configuration is depicted on Figure C-14. The purpose of this configuration is to allow water levels within Everglades National Park (ENP) to be raised to appropriate MWD or NSM levels. The seepage canal collects water which infiltrates through the levee to prevent deleterious changes on the water surface elevation within the 8.5 SMA. The interior berm is positioned to prevent surface water from entering the seepage canal. Based on previous work effort, surface water from the residential area was expected to have the potential for inferior quality water when compared to that of the seepage canal.

The perimeter levee has a length of 40,200 feet, a top width of 20 feet and an elevation of 10.2 feet as developed in the GDM. The seepage canal will be cut to a similar depth throughout to allow for flow either to the north or to the south depending on the future improvements. For this Alternative, the width of the canal will be relatively consistent throughout its length as shown in Table C-14.

A. Alternative No. 9 contemplates the pumpage of water from the seepage canal initially to the north as is projected in Alternative No. 1. In the future, when improvements to the south have been completed, pumpage of seepage water could be to the south as is depicted in Alternative No. 2. A pump station designated S-357A is to be constructed at the northeastern end of the seepage collection canal to pump water into the L-31N canal for conveyance north to the L-29 canal adjacent to ENP and Northeast Shark River Slough. A similar pump station, S-357B, will be constructed at the southern terminus of the seepage canal.

Alternative No. 9 is considered to be a flood mitigation alternative. By USACE definition, a flood mitigation alternative provides limits damages to the residents within the 8.5 SMA from flood stages no greater than currently exist within the area. Thus, the alternative does not change the existing storm water management level of service to the 8.5 SMA.

B. Levees and Canal. The perimeter levee has an estimated length of 40,200 feet, a top width of 20 feet and an elevation of 10.2 feet as shown on Figure C-2. The seepage canal shown on Figure C-3 varies in width and depth depending on the location relative to the proposed pump stations S-357A or S-357B. The canal has been designed so that all of the seepage either flows north to pump station S-357A or south to pump station S-357B. For Alternative No. 9, the width varies from 40 feet at either end to 30 feet near the middle for Segments El-E and E-F shown in Table C-12, with a variation in depth from 15 feet at either end to 12.5 feet in the middle.

During the construction of the L-31N canal and in subsequent investigations, it has been found that the residential area is underlain by a thin layer of silt and peat. This thin layer of organic material is expected to pose no problems for either the construction or the stability of the levee because of its relatively shallow depth. Additionally, the Soil Survey of Dade County Area, Florida (1996) indicates that marl or limestone rock is exposed at or near the ground surface along the western and northern perimeter of the 8.5 SMA. Medium hard to hard highly permeable limestone rock is expected to be encountered from the ground surface to below the canal invert elevation.

The seepage canal is designed for the flow rates calculated by the USACE using the "MODBRANCH" model. Based on the results of the USACE analyses, a total

flow rate of 500 cfs is anticipated at either end the seepage canal as presented for Alternative 1 and 2. This flow rate can be equally distributed along the 40,200 feet of canal to allow sizing of the canal cross-sections for each segment shown on Figure C-14. The calculated canal sections are shown in Table C-14. A canal bottom slope of 0.000013 ft/ft was used to calculate the canal flow rate; this is a gradient of 0.5 feet over the 40,200 feet canal length. The estimated excavation volume, assuming a 20% overcut, would be 1,254,450 cubic yards cy.

The canal will be formed by drilling, blasting and excavating of the limestone rock. The blasting and excavation should reduce the limestone rock to a graded cobble, gravel and sand mixture. The excavated material should be suitable for the levee construction provided the material is crushed and processed; the maximum particle size of the crushed rock should be less than 2 inches.

-

The levee cross-sections are shown in Figures C-2 and C-3. A woven geotextile is recommended beneath the levees to stop migration of embankment fill into the porous limestone and to distribute the embankment load if localized peat/muck deposits are encountered. A geomembrane will be required on the ENP side of the perimeter levee to reduce the seepage through the levee. Additionally, a non-woven geotextile is recommended above/below the geomembrane to reduce the potential of punctures caused by the angular processed fill material. A total levee volume of 562,700 cy is required. Therefore, there is a net export of approximately 691,750 cy. The net export material will either be used in an expanded levee, stockpiled or sold.

C. Structures. Pump station designated S-357A and S-357B are to be constructed at the northeastern and southern ends of the seepage collection canal, respectively. The S-357A pump station constructed initially, will pump water into the L-31N canal for conveyance north to the L-29 canal adjacent to ENP and NESRS. The S-357B pump station constructed in the future will pump water into the 120-inch diameter pipeline for conveyance south to the C-111 system. Each pump station will discharge to a capacity of 500 cfs.

The pump stations will be equipped with diesel powered axial flow pumps with a design head of less than 10 feet. A conveyance channel will be required for the S-357 pump station to connect it to canal L-31N. Additionally, 200 feet of the seepage canal will be lined with concrete and training walls constructed to connect the seepage canal to the pump intake structure.

The pump stations will consist of a reinforced concrete structure supporting the pumps and a reinforced concrete gated spillway, a superstructure consisting of concrete block walls and reinforced concrete rigid frames will be used to house the pumping units. An intake structure with a bay for each pumping unit will be constructed including a trash rack and service bridge.

D. Seepage Barrier. This item is not required for this Alternative.

E. Raise Roads. This item is not required for this Alternative.

F. Infrastructure. A pump station access road will be constructed to El 10.2. This roadway will consist of a structural section of 2 inches asphalt over 8 inches of limerock base. The road will be 20 feet wide including the shoulders. A diesel fuel storage tank will be required for the pump engines and electric utilities required for support equipment and lighting.

G. Real Estate Needs. – Real Estate requirements for the project consist of the development of a gross appraisal for the impacts of each alternative. The Real Estate Appendix outlines the methodology for the evaluation of real estate costs. The costs determined in the Appendix are used where appropriate in the discussion of the costs for each alternative.

H. O&M Requirements. O&M for the levee should consist of an annual visual inspection. A detailed inspection plan will be developed; however, at a minimum, the following should be noted during each inspection:

- Surface erosion gullies
- Excessive levee settlement
- Exposure of the geomembrane

The crushed processed canal rock material should be relatively durable and not prone to erosion. Vegetating the slopes is not necessary; some natural vegetation may occur with time. The shallow rooted vegetation may also reduce slope erosion. Any identified problem should be corrected.

The O&M costs for the pump stations has been estimated based on information supplied by both the USACE SFWMD. This cost is $298,950 per year and consists of specific operations and maintenance activities needed to insure that the generators and pumps operate as designed.

I. Permitting – Permitting considers those permits necessary to construct and operate the alternative. These permits are addressed in the SEIS and are referenced herein.

J. Construction Plan. After clearing and grubbing the construction site, the basic construction sequence will consist of drilling, blasting and excavating the collection seepage canal in accordance with the canal dimensions presented in Table C-14. It is anticipated that the excavated canal surface will be relatively rough from the blasting/excavation process. The excavated material will be comprised of a graded material consisting of sand size to rock size particles; relatively large pieces of rock may be generated by the blasting operation because of the relatively shallow blasting and variable limestone hardness. A crusher will be required to process the blast rock to produce the levee fill material. The rock should be crushed to a maximum particle size of 2 inches.

The blasting operation will produce transient vibrations that will attenuate with increased distance from the blast location. The vibrations produced by blasting should be barely perceptible to humans at a distance of approximately 1-mile and distinctly perceptible at a distance of ¼ to ½ mile. For structures located within a distance of ¼ mile of the blasting operations, vibration levels should be measured, and shot charges may need to be adjusted to maintain a vibration level below a peak particle velocity of 0.5 inches per second.

The canal blast rock is suitable as fill for levee construction. This material can be excavated with conventional excavating equipment. A crusher will be required to reduce the limestone rock to sand-gravel gradation with maximum particle size less than 2 inches.

The levee construction will consist of the following general construction sequence:

1. Place woven geotextile beneath levee embankment.

2. Construct interior levee and core of perimeter levee.

3. Shape levee surface.

4. Place non-woven geotextile "cushion" on upstream 3:1 (H:V) face of perimeter levee in areas where geomembrane will be placed.

5. Place non-woven geotextile above geomembrane.

6. Complete construction of perimeter levee.

Dewatering will be required for the construction of the reinforced concrete pumping station. Blasting may also be required for foundation construction and for the intake canal and discharge pool.

K. Demolition. Alternative No. 9 calls for the placement of a perimeter levee, seepage canal, and internal levee on land that is owned or is in the process of being acquired by the USACE. If not currently cleared, the property will be cleared of all structures and regraded to facilitate the placement of the required facilities. Additionally, lands purchased by the SFWMD may have to be regraded to meet wetland creation needs. Additionally, management of the purchased lands will reduce exotic vegetation and promote viable wetland habitat.

The SFWMD will be the entity that will manage the area that is allowed to migrate to wetland conditions. These costs will include not only demolition and disposal but will also provide information on costs to manage the property for the project life. Structure removal costs have been developed from the information generated and described in the Real Estate Appendix.

L. Cost Estimate. The preliminary cost estimates for Alternative No. 9 is $39,903,652. This cost estimate includes both the pumping stations S-357A and S-357B and the 2,000 lf of 120-inch diameter pipeline. The preliminary cost summary sheet for Alternative No. 9 is presented in Table C-15. The unit rates used to estimate the costs were obtained from the following sources:

1. Current SFWMD projects

2. Local contractors currently working on similar projects in Southern Florida

3. Equipment manufactures and suppliers.

In addition to the Capital Costs associated with the alternative there are costs that can be considered to be either replacement or annual costs. Replacement costs consider the cost of replacing facilities and structures. In this alternative, replacement costs consider the replacement of the pumps at the half-way point in the 50-year life-cycle and the replacement of the asphalt roadway. Annual costs consider the operations and maintenance costs for the pump station and ecological maintenance that has to occur. Replacement costs for pumps and roadways is annualized to $71,214. Annual cost for pump station operations and maintenance is $298,950. This is the same number used for the other alternatives with only one pump station because it is assumed that only one pump station will be operating at any given time.

Annual costs for ecological maintenance assume that the area that is deemed to be converted to wetlands is regraded to appropriate contours for natural wetland recruitment. The cost of this regrading is considered a Capital Cost. Ecological operations and maintenance considers the effort necessary for the removal of nuisance species during the period (5-years) when natural recruitment is occurring. After 5-years, it is believed that the wetlands will be established and will not require the same level of effort as initially expended. Alternative No. 9 considers minimal restoration of wetlands. Thus, the annual cost includes only periodic maintenance estimated to be $20,000. Water quality monitoring for the discharge from the pumping station is estimated at $147,033 per year. The costs for all alternatives are summarized on Tables C-3 and C-4.

M. Alternative Performance. Alternative No. 9 is designed to provide water surface level mitigation to the 8.5 SMA while improving the water elevations and flows within the ENP. Mitigation is provided by the alternative over most of the 8.5 SMA. A small area, immediately adjacent to L-31N does not receive mitigation. The extent of wetlands and their hydroperiod within the ENP is improved over the pre-MWD condition and thus, this alternative does allow for an improvement in the overall ENP ecological condition.

PROJECT IMPLEMENTATION

10. Implementation

One of the essential components of the evaluation of alternatives is the time that it will take to implement. Alternative No. 1, the Authorized GDM Plan can be completed by the December 31, 2003 schedule that has been approved for the project. If other alternatives are to be implemented, the period for implementation must be developed and compared.

Alternative No. 1 has been in the process of implementation for some time. Most of the properties that would be used in the construction of Alternatives Nos. 1, 2, and 9 have been acquired. Remaining work efforts for these alternatives includes design, permitting and construction. Monitoring and operations and maintenance efforts begin following construction and continue for the appropriate periods.

All of the other alternatives (Alternatives Nos. 3,4,5,6,7,and 8) require the purchase of additional property and easements. Based on the information supplied by the SFWMD there are a number of property owners who will likely be unwilling to accept any of these alternatives. For those properties, condemnation will have to occur. At this writing, condemnation authority is available to the U.S. Army Corps of Engineers for the Authorized Project. Condemnation authority for this project either will fall to the USACE (if a new PLA is provided) or to the SFWMD. At this time, the SFWMD does not have condemnation authority but could receive it from the State Legislature.

It is estimated that obtaining condemnation authority could take up to 12-months. Following receipt of condemnation authority, it is projected that "Quick Claim" title transfers would take up to two years to occur. Finally, demolition of acquired property, depending on the number of structures could be completed in less than six months. This means that for properties that must be purchased or have easements are required for the project a total estimated implementation time of approximately 3.5 years is projected.

Table C-16 projects the total duration and completion date for each alternative. A primary assumption is that condemnation authority will be available for use in land acquisition. Administrative time can occur during the land acquisition phase. However, it is assumed that if a PAL is required it can be received by January 2001.

Central and Southern Florida Project
Modified Water Deliveries to
Everglades National Park, Florida

8.5 Square Mile Area

Appendix C
Preliminary Engineering and Costs

TABLES

Department of the Army

Jacksonville District, USACE of Engineers

Jacksonville, Florida

April 2000

HDR Engineering, Inc.

Table C-1

Canal Dimensions

Alternative No. 1

Authorized GDM Plan

Corp. Calculated Flow Rate = 500 cfs delta H = 0.5 ft

Total Length = 40,170 ft slope = 1E-05 ft/ft

Flow Rate per LF = 0.0124471 cfs/lf El. G.S. = 6.5 ft

Segment – South to North	Segment Length	Canal Dimensions		
		Bottom Width	Bottom Depth	Bottom Elevation
		(ft)	(ft)	(ft)
I-J	6125	15	8	-1.5
H-I	930	20	9.5	-3
G-H	5625	25	11	-4.5
F-G	2980	25	11	-4.5
E-F	5260	30	12.5	-6
E1-E	3680	30	12.5	-6
D-E1	4960	40	12.5	-6
C-D	5350	40	15	-8.5
A-C	5260	40	15	-8.5

Table C-2
Preliminary Cost Summary Sheet
Alternative #1
Authorized GDM Plan

Description	Quantity	Unit	Unit Cost	Extended Cost
Blast and Excavate	957,904	CY	$7.00	$6,705,327
Crush and Process Rock	957,904	CY	$2.00	$1,915,808
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	88977	CY	$2.00	$177,954
1 Mile (25%)	111221	CY	$2.75	$305,858
2 Miles (25%)	111221	CY	$3.50	$389,274
3 Miles (30%)	133465	CY	$4.50	$600,594
Shape and Compact	444885	CY	$1.40	$622,838
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	18750	CY	$2.00	$37,500
1 Mile (25%)	25000	CY	$2.75	$68,750
2 Miles (25%)	25000	CY	$3.50	$87,500
3 Miles (30%)	31250	CY	$4.50	$140,625
Shape and Compact	117832	CY	$1.40	$164,965
Geofabrics				
Geomembrane and nonwoven geotextile(perimeter levee)	1944228	SFT	$0.55	$1,069,325
Woven Geotextile (perimeter and interior levee)	368225	SY	$1.40	$515,515
Pump Station Access Road				
Fill	1000	CY	$12.00	$12,000
8" Rock Base	2224	SY	$8.50	$18,904
2" Wear Surface	1986	SY	$6.50	$12,909
Conveyance Channel				
S-357 Pump Station Discharge	1	EA	$500,000	$500,000
Demolition (1)				
Clear and Grub	0	AC	$2,000	$0
Homes (wells, septic, pads etc.)	0	EA	$8,000	$0
Pump Station North S-357 (500 cfs)	1	EA	$5,040,000	$5,040,000
Subtotal Construction				$18,385,647
Contingency (20%)				$3,677,129
Total Construction Cost				$22,062,776
Planning, Engineering, Design, Construction Management (20%)				$4,412,555
Land Acquisition (2)	663	AC		$4,110,200
Total				$30,585,531

(1) Assumes no restoration necessary
(2) Land Acquisition Values are taken from the Real Estate Appendix.

Table C-3
Initial Cost Summary
March 2000 Price Levels

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
Channels and Canals									
Blast and Excavate	$6,705,327	$6,423,859	$3,623,004	$0	$0	$2,883,895	$0	$3,796,564	$4,390,560
Crush and Process Rock	$1,915,808	$1,835,388	$1,035,144	$0	$0	$823,970	$0	$976,259	$2,508,892
Perimeter Levee	$2,096,518	$2,096,518	$2,096,518	$0	$0	$1,196,758	$0	$1,183,900	$2,096,518
Internal Levee	$499,340	$499,340	$555,283	$0	$0	$257,880	$0	$273,709	$499,340
Geofabrics	$1,584,840	$1,584,840	$515,515	$0	$0	$1,035,096	$0	$922,050	$1,584,840
Pump Station(s)									
S-357	$5,040,000	$5,040,000	$0	$0	$0	$5,040,000	$0	$5,040,000	$5,040,000
S-357B									$5,040,000
Access Road (S-357)	$43,813	$43,698	$43,698	$0	$0	$43,813	$0	$43,813	$43,813
Conveyance Channel (S-357	$500,000	$500,000	$0	$0	$0	$500,000	$0	$500,000	$1,000,000
Seepage Barrier			$82,804,313						
Main Asphalt Roadways							$2,064,995		
Dirt Roadways							$5,696,527	$0	$0
Miscellaneous Drainage Structures							$8,400,000		
Pipeline and Spreader Swale to C-111		$2,652,600				$2,652,600		$2,652,600	$2,652,600
Demolition	$0	$0	$422,957	$6,986,000	$10,746,000	$7,212,000	$558,000	$3,200,000	$0
Total Contruction Costs	$18,385,647	$20,676,244	$91,096,432	$6,986,000	$10,746,000	$21,646,011	$16,719,522	$18,588,896	$24,856,564
Land Costs	$4,110,200	$4,110,200	$110,195,194	$122,757,273	$164,884,269	$112,682,624	$111,924,923	$115,421,808	$4,110,200
Total Contruction and Real Estate Costs	$22,495,847	$24,786,444	$201,291,626	$129,743,273	$175,630,269	$134,328,635	$128,644,445	$134,010,704	$28,966,764
Construction Cost Uncertainty (20%)	$3,677,129	$4,135,249	$18,219,286	$698,600	$1,074,600	$4,329,202	$3,343,904	$3,717,779	$4,971,313
				10%	10%				
Planning, Engineering and Design	$1,985,650	$2,233,034	$9,838,415	$691,614	$1,063,854	$2,337,769	$1,805,708	$2,007,601	$2,684,509
Construction Management	$2,426,905	$2,729,264	$12,024,729	$845,306	$1,300,266	$2,857,274	$2,206,977	$2,453,734	$3,281,066
Total Non-Construction Costs	$8,089,684	$9,097,548	$40,082,430	$2,235,520	$3,438,720	$9,524,245	$7,356,590	$8,179,114	$10,936,888
Total Initial Costs	$30,585,531	$33,883,992	$241,374,057	$131,978,793	$179,068,989	$143,852,880	$136,001,034	$142,189,819	$39,903,652
Rounded:	$30,585,500	$33,884,000	$241,374,100	$131,978,800	$179,069,000	$143,852,900	$136,001,000	$142,189,800	$39,903,700

Annual Cost Summary

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
Total Project Investment	$33,794,254	$37,438,803	$266,696,888	$145,824,822	$197,855,301	$158,944,646	$150,268,995	$157,107,068	$44,090,035
Interest and Amortization	2,333,279	2,584,911	18,413,726	10,068,278	13,660,652	10,974,118	10,375,119	10,847,245	3,044,137
Operations and Maintenance Costs	$249,875	$318,950	$20,000	$106,687	$106,687	$404,265	$106,687	$345,413	$318,950
Equipment Replacement Costs	$35,607	$35,607	$0	$0	$0	$35,607	$432,426	$35,607	$71,214
Water Quality Monitoring Costs	$147,033	$147,033	$0	$0	$0	$147,033	$0	$147,033	$147,033
Total Annual Cost	$2,765,794	$3,086,502	$18,433,726	$10,174,965	$13,767,339	$11,561,024	$10,914,232	$11,375,298	$3,581,334

Table C-4
Annual Cost Summary

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
Interest Rate	6.625%	6.625%	6.625%	6.625%	6.625%	6.625%	6.625%	6.625%	6.625%
Initial Cost	$30,585,500	$33,884,000	$241,374,100	$131,978,800	$179,069,000	$143,852,900	$136,001,000	$142,189,800	$39,903,700
Interest During Construction	$3,208,754	$3,554,803	$25,322,788	$13,846,022	$18,786,301	$15,091,746	$14,267,995	$14,917,268	$4,186,335
Annualized Interest	$1,129,644	$1,251,471	$8,914,908	$4,874,503	$6,613,732	$5,313,061	$5,023,059	$5,251,636	$1,473,803
Interest Cost per Year	$2,333,279	$2,584,911	$18,413,726	$10,068,278	$13,660,652	$10,974,118	$10,375,119	$10,847,245	$3,044,137
Replacement Costs for Pumps and Roadways	$35,607	$35,607	$0	$0	$0	$35,607	$432,426	$35,607	$71,214
(Assumes replacement of Asphalt roads and									
pumps @ 25-years, replacement of dirt roads									

@ 10-years) (pump cost 1/2 of full station costs)									
Operation and Maintenance	$229,875	$298,950				$298,950		$298,950	$298,950
(Assumes energy, labor, and miscellaneous costs)									
Ecological Operations and Maintenance	$20,000	$20,000	$20,000	$106,687	$106,687	$105,315	$106,687	$46,463	$20,000
(Assumes intensive management for two years									
(four times/year), fire management for five years,									
continous maintenance for life of project (50-years))									
Water Quality Monitoring Costs	$147,033	$147,033				$147,033		$147,033	$147,033
(Cost to monitor point source discharge (pumpage))									
Total Annual Cost	$2,765,794	$3,086,502	$18,433,726	$10,174,965	$13,767,339	$11,561,024	$10,914,232	$11,375,298	$3,581,334

Table C-5

Canal Dimensions

Alternative No. 2

Corp. Calculated Flow Rate = 500 cfs delta H = 0.5 ft

Total Length = 40,170 ft slope = 1E-05 ft/ft

Flow Rate per LF = 0.0124471 cfs/lf El. G.S. = 6.5 ft

Segment – North to South	Segment Length	Canal Dimensions		
		Bottom Width	Bottom Depth	Bottom Elevation
		(ft)	(ft)	(ft)
A-C	5260	15	8	-1.5

C-D	5350	20	9.5	-3
D-E1	4960	25	11	-4.5
E1-E	3680	30	12.5	-6
E-F	5260	30	12.5	-6
F-G	2980	40	12.5	-6
G-H	5625	40	12.5	-6
H-I	930	40	15	-8.5
I-J	6125	40	15	-8.5

Table C-6
Preliminary Cost Summary Sheet
Alternative #2
Modified GDM Plan

Description	Quantity	Unit	Unit Cost [1]	Extended Cost
Blast and Excavate	917,694	CY	$7.00	$6,423,859
Crush and Process Rock	917694	CY	$2.00	$1,835,388
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	88977	CY	$2.00	$177,954
1 Mile (25%)	111221	CY	$2.75	$305,858
2 Miles (25%)	111221	CY	$3.50	$389,274
3 Miles (30%)	133465	CY	$4.50	$600,594
Shape and Compact	444885	CY	$1.40	$622,838
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	18750	CY	$2.00	$37,500
1 Mile (25%)	25000	CY	$2.75	$68,750
2 Miles (25%)	25000	CY	$3.50	$87,500
3 Miles (30%)	31250	CY	$4.50	$140,625
Shape and Compact	117832	CY	$1.40	$164,965
Geofabrics				
Geomembrane and nonwoven geotextile(perimeter levee)	1944228	SFT	$0.55	$1,069,325
Woven Geotextile (perimeter and interior levee)	368225	SY	$1.40	$515,515
Pump Station Access Road				
Fill	1000	CY	$12.00	$12,000
8" Rock Base	2224	SY	$8.50	$18,908
2" Wear Surface	1986	SY	$6.50	$12,791
Conveyance Channel				
S-357 Pump Station Discharge	1	EA	$500,000	$500,000
Demolition (1)				
Clear and Grub	0	AC	$2,000	$0
Homes (wells, septic, pads etc.)	0	EA	$8,000	$0
Pump Station South S-357 (500 cfs)	1	EA	$5,040,000	$5,040,000
Pipeline to C-111, (120-inch-diameter)	2000	LF	$960.00	$1,920,000
Spreader Swale				
Blast and Excavate	62333	CY	$3.50	$218,167
Crush and Process Rock	62333	CY	$2.00	$124,667
Perimeter Levee (Haul, shape, compact)	62333	CY	$4.40	$274,267
Woven Geotextile	82500	SY	$1.40	$115,500
Subtotal Construction				$20,676,244
Contingency (20%)				$4,135,249
Total Construction Cost				$24,811,493
Planning, Engineering, Design, Construction Management (20%)				$4,962,299
Land Acquisition (2)	663	AC		$4,110,200
Total				$33,883,992

(1) Assumes no restoration necessary
(2) Land Acquisition Values are taken from the Real Estate Appendix.

Table C-7

Canal Dimensions

Alternative No. 3

Deep Seepage Barrier Plan

Corp. Calculated Flow Rate = 500 cfs delta H = 0.5 ft

Total Length = 40,170 ft slope = 1E-05 ft/ft

Flow Rate per LF = 0.0124471 cfs/lf El. G.S. = 6.5 ft

Segment – South to North	Segment Length	Canal Dimensions		
		Bottom Width	Bottom Depth	Bottom Elevation
		(ft)	(ft)	(ft)
A-C	5260	10	6.5	-1.5
C-D	5350	15	8	-3
D-E1	4960	20	9.5	-3
E1-E	3680	20	9.5	-3
E-F	5260	20	9.5	-4.5
F-G	2980	25	11	-4.5
G-H	5625	25	11	-4.5
H-I	930	25	11	-4.5
I-J	6125	30	12.5	-6.0

Table C-8
Preliminary Cost Summary Sheet
Alternative #3
Deep Seepage Barrier Plan

Description	Quantity	Unit	Unit Cost	Extended Cost
Blast and Excavate	517572	CY	$7.00	$3,623,004
Crush and Process Rock	517572	CY	$2.00	$1,035,144
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	88977	CY	$2.00	$177,954
1 Mile (25%)	111221	CY	$2.75	$305,858
2 Miles (25%)	111221	CY	$3.50	$389,274
3 Miles (30%)	133465	CY	$4.50	$600,594
Shape and Compact	444885	CY	$1.40	$622,838
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	23566	CY	$2.00	$47,133
1 Mile (25%)	29458	CY	$2.75	$81,010
2 Miles (25%)	29458	CY	$3.50	$103,103
3 Miles (30%)	35350	CY	$4.50	$159,073
Shape and Compact	117832	CY	$1.40	$164,965
Geofabrics				
Geomembrane and nonwoven geotextile(perimeter levee)	0	SFT	$0.55	$0
Woven Geotextile (perimeter levee)	368225	SY	$1.40	$515,515
Pump Station Access Road				
Fill	0	CY	$12.00	$12,000
8" Rock Base	0	SY	$8.50	$18,908
2" Wear Surface	0	SY	$6.50	$12,791
	0			
Conveyance Channel				
S-357 Pump Station Discharge	0	EA	$500,000	$0
Demolition (1)				
Clear and Grub	11	AC	$2,000	$22,957
Homes (wells, septic, pads etc.)	50	EA	$8,000	$400,000
Seepage Barrier	52325	LF	$1,583	$82,804,313
Pump Station South S-357 (225 cfs)		EA	$2,817,600	$0
Pipeline to C-111 (84-inch-diameter)		LF	$672.00	$0
Subtotal Construction				$91,096,432
Contingency (20%)				$18,219,286
Total Construction Cost				$109,315,719
Planning, Engineering, Design, Construction Management (20%)				$21,863,144
Land Acquisition (2)	5825	AC		$110,195,194
Total				$241,374,057

(1) Assumes no restoration necessary, 50 relocations from Real Estate Appendix
(2) Land Acquisition Values are taken from the Real Estate Appendix.

Table C-9
Preliminary Cost Summary Sheet
Alternative # 4
Resident Choice Land Acquisition Plan

Description	Quantity	Unit	Unit Cost [1]	Extended Cost
Blast and Excavate	0	CY	$7.00	$0
Crush and Process Rock	0	CY	$2.00	$0
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	0	CY	$2.00	$0
1 Mile (25%)	0	CY	$2.75	$0
2 Miles (25%)	0	CY	$3.50	$0
3 Miles (30%)	0	CY	$4.50	$0
Shape and Compact	0	CY	$1.40	$0
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	0	CY	$2.00	$0
1 Mile (25%)	0	CY	$2.75	$0
2 Miles (25%)	0	CY	$3.50	$0
3 Miles (30%)	0	CY	$4.50	$0
Shape and Compact	0	CY	$1.40	$0
Geofabrics				
Geomembrane and nonwoven geotextile(perimeter levee)	0	SFT	$0.55	$0
Woven Geotextile (perimeter and interior levee)	0	SY	$1.40	$0
Pump Station Access Road				
Fill	0	CY	$12.00	$0
8" Rock Base	0	SY	$8.50	$0
2" Wear Surface	0	SY	$6.50	$0
Conveyance Channel				
Pump Station Discharge	0	EA	$500,000	$0
Demolition (1)				
Clear and Grub	79	AC	$2,000	$158,000
Homes (wells, septic, pads etc.)	44	EA	$8,000	$352,000
Regrade to Wetland (scrape down 0.5 feet and remove unusable material)	1619	AC	$4,000	$6,476,000
Subtotal Construction				$6,986,000
Contingency (10%)				$698,600
Total Construction Cost				$7,684,600
Planning, Engineering, Design, Construction Management (20%)				$1,536,920
Land Acquisition (2)	6413	AC		$122,757,273
Total				$131,978,793

(1) Based on Ecological Restoration Need

(2) Land Acquisition Values are taken from the Real Estate Appendix.
('Includes cost for easements, fee simple, life estates and those costs required for implementation including raising septic tanks and wells and relocation costs.)

Table C-10
Preliminary Cost Summary Sheet
Alternative # 5
Total Buy-Out Plan

Description	Quantity	Unit	Unit Cost [1]	Extended Cost
Blast and Excavate	0	CY	$7.00	$0
Crush and Process Rock	0	CY	$2.00	$0
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	0	CY	$2.00	$0
1 Mile (25%)	0	CY	$2.75	$0
2 Miles (25%)	0	CY	$3.50	$0
3 Miles (30%)	0	CY	$4.50	$0
Shape and Compact	0	CY	$1.40	$0
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	0	CY	$2.00	$0
1 Mile (25%)	0	CY	$2.75	$0
2 Miles (25%)	0	CY	$3.50	$0
3 Miles (30%)	0	CY	$4.50	$0
Shape and Compact	0	CY	$1.40	$0
Geofabrics				
Geomembrane and nonwoven geotextile(perimeter levee)	0	SFT	$0.55	$0
Woven Geotextile (perimeter and interior levee)	0	SY	$1.40	$0
Pump Station Access Road				
Fill	0	CY	$12.00	$0
8" Rock Base	0	SY	$8.50	$0
2" Wear Surface	0	SY	$6.50	$0
Conveyance Channel				
Pump Station Discharge	0	EA	$500,000	$0
Demolition (1)				
Clear and Grub	79	AC	$2,000	$158,000
Homes (wells, septic, pads etc.)	514	EA	$8,000	$4,112,000
Regrade to Wetland (scrape down 0.5 feet and remove unusable material)	1619	AC	$4,000	$6,476,000
Subtotal Construction				$10,746,000
Contingency (10%)				$1,074,600
Total Construction Cost				$11,820,600
Planning, Engineering, Design, Construction Management (20%)				$2,364,120
Land Acquisition (1)	6413	AC		$164,884,269
Total				$179,068,989

(1) Based on Ecological Restoration Need
(2) Land Acquisition Values are taken from the Real Estate Appendix.
('Includes cost for easements, fee simple, life estates and those costs required for implementation including raising septic tanks and wells and relocation costs.)

Table C-11

Canal Dimensions

Alternative No. 6

Western Area as Buffer Plan

Corp. Calculated Flow Rate = 500 cfs delta H = 0.5 ft

Total Length = 19,320 ft slope = 1E-05 ft/ft

Flow Rate per LF = 0.0124471 cfs/lf El. G.S. = 6.5 ft

Segment North to South	Segment Length	Canal Dimensions		
		Bottom Width	Bottom Depth	Bottom Elevation
		(ft)	(ft)	(ft)
A-B	--	--	--	--
B-C	--	--	--	--
C-D	--	--	--	--
D-D1	--	--	--	--
D2-D1	7350	25	11	-4.5
D-E	11970	30	12.5	-6.5

Table C-12
Preliminary Cost Summary Sheet
Alternative #6
Western Area as Buffer Plan

Description	Quantity	Unit	Unit Cost	Extended Cost
Blast and Excavate	411,985	CY	$7.00	$2,883,895
Crush and Process Rock	411,985	CY	$2.00	$823,970
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	55663	CY	$2.00	$111,326
1 Mile (40%)	111326	CY	$2.75	$306,147
2 Miles (40%)	111326	CY	$3.50	$389,642
			$4.50	
Shape and Compact	278315.9	CY	$1.40	$389,642
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	11994	CY	$2.00	$23,989
1 Mile (40%)	23989	CY	$2.75	$65,969
2 Miles (40%)	23989	CY	$3.50	$83,961
Shape and Compact	59972	CY	$1.40	$83,961
Geofabrics				
Geomembrane and nonwoven geotextile(perimeter levee)	1216292	SF	$0.55	$668,961
Woven Geotextile (perimeter and interior levee)	261525	SY	$1.40	$366,135
Pump Station Access Road				
Fill	1000	CY	$12.00	$12,000
8" Rock Base	2224	SY	$8.50	$18,904
2" Wear Surface	1986	SY	$6.50	$12,909
Conveyance Channel				
S-357 Pump Station Discharge	1	EA	$500,000	$500,000
Demolition (1)				
Clear and Grub	74	AC	$2,000	$148,000
Homes (wells, septic, pads etc.)	353	EA	$8,000	$2,824,000
Regrade to Wetland (scrape down 0.5 feet and remove unusable material)	1060	AC	$4,000	$4,240,000
Pump Station South S-357 (500 cfs)	1	EA	$5,040,000	$5,040,000
Pipeline to C-111, (120-inch-diameter)	2000	LF	$960	$1,920,000
Spreader Swale				
Blast and Excavate	62333	CY	$3.50	$218,167
Crush and Process Rock	62333	CY	$2.00	$124,667
Perimeter Levee (Haul, shape, compact)	62333	CY	$4.40	$274,267
Woven Geotextile	82500	SY	$1.40	$115,500
Subtotal Construction				$21,646,011
Contingency (20%)				$4,329,202
Total Construction Cost				$25,975,214
Planning, Engineering, Design, Construction Management (20%)				$5,195,043
Land Acquisition (2)	4196	AC		$112,682,624
Total				$143,852,880

(1) Based on Ecological Restoration Need
(2) Land Acquisition Values are taken from the Real Estate Appendix.
('Includes cost for easements, fee simple, life estates and those costs required for implementation

Table C-13
Preliminary Cost Summary Sheet
Alternative #7
Raise All Public Roads Plan (in-kind)

Description	Quantity	Unit	Unit Cost [1]	Extended Cost
Fill Development and Canal Construction				
Blast and Excavate	0	CY	$7.00	$0
Crush and Process Rock	0	CY	$2.00	$0
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	0	CY	$2.00	$0
1 Mile (25%)	0	CY	$2.75	$0
2 Miles (25%)	0	CY	$3.50	$0
3 Miles (30%)	0	CY	$4.50	$0
Shape and Compact	0	CY	$1.40	$0
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	0	CY	$2.00	$0
1 Mile (25%)	0	CY	$2.75	$0
2 Miles (25%)	0	CY	$3.50	$0
3 Miles (30%)	0	CY	$4.50	$0
Shape and Compact	0	CY	$1.40	$0
Main Asphalt Roadways, 5.3 miles (1)				
Fill (fill depth of 2.2 ft)	171934	CY	$5.50	$945,635
8" Rock Base	74624	SY	$8.50	$634,304
2" Wear Surface	74624	SY	$6.50	$485,056
Dirt Roadways, 49.7 miles (1)				
Fill (fill depth of 2.2 ft)	1265895	CY	$4.50	$5,696,527
Miscellaneous Drainage Structures (2)	300	EA	$28,000	$8,400,000
Conveyance Channel				
Pump Station Discharge	0	EA	$500,000	$0
Demolition (3)				
Clear and Grub	79	AC	$2,000	$158,000
Homes (wells, septic, pads etc.)	50	EA	$8,000	$400,000
Subtotal Construction				$16,719,522
Contingency (20%)				$3,343,904
Total Construction Cost				$20,063,426
Planning, Engineering, Design, Construction Management (20%)				$4,012,685
Land Acquisition (4)	5839	AC		$111,924,923
Total				$136,001,034

(1) Assumes replacement inking. Range to bring to Miami-Dade County standards discussed in text.
(2) Assumed number of conveyance connections needed to maintain flow.
(3) Based on Ecological Restoration Need
(4) Land Acquisition Values are taken from the Real Estate Appendix.
('Includes cost for easements, fee simple, life estates and those costs required for implementation including raising septic tanks and wells and relocation costs.)

Table C-14
Preliminary Cost Summary Sheet
Alternative # 8
Western Area as a Flow-Way Plan

Description	Quantity	Unit	Unit Cost [1]	Extended Cost
Excavate	542,366	CY	$7.00	$3,796,564
Crush and Process Rock	488,130	CY	$2.00	$976,259
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	55065	CY	$2.00	$110,130
1 Mile (40%)	110130	CY	$2.75	$302,858
2 Miles (40%)	110130	CY	$3.50	$385,456
			$4.50	
Shape and Compact	275326	CY	$1.40	$385,456
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	12731	CY	$2.00	$25,461
1 Mile (40%)	25461	CY	$2.75	$70,019
2 Miles (40%)	25461	CY	$3.50	$89,115
Shape and Compact	63653	CY	$1.40	$89,115
Geofabrics				
Geomembrane and nonwoven geotextile(perimeter levee)	1203224	SFT	$0.55	$661,773
Woven Geotextile (perimeter and interior levee)	185912	SY	$1.40	$260,277
Pump Station Access Road				
Fill	1000	CY	$12.00	$12,000
8" Rock Base	2224	SY	$8.50	$18,904
2" Wear Surface	1986	SY	$6.50	$12,909
Conveyance Channel				
Pump Station Discharge	1	EA	$500,000	$500,000
Demolition (1)				
Clear and Grub	35	AC	$2,000	$70,000
Homes (wells, septic, pads etc.)	319	EA	$8,000	$2,552,000
Regrade to Wetland (scrape down 0.5 feet and remove unusable material)	289	AC	$2,000	$578,000
Pump Station South S-357 (500 cfs)	1	EA	$5,040,000	$5,040,000
Pipeline to C-111, (120-inch-diameter)	2000	LF	$960.00	$1,920,000
Spreader Swale				
Blast and Excavate	62333	CY	$3.50	$218,167
Crush and Process Rock	62333	CY	$2.00	$124,667
Perimeter Levee (Haul, shape, compact)	62333	CY	$4.40	$274,267
Woven Geotextile	82500	SY	$1.40	$115,500
Subtotal Construction				$18,588,896
Contingency (20%)				$3,717,779
Total Construction Cost				$22,306,675
Planning, Engineering, Design, Construction Management (20%)				$4,461,335
Land Acquisition (2)	5803	AC		$115,421,808
Total				$142,189,819

(1) Based on Ecological Restoration Need
(2) Land Acquisition Values are taken from the Real Estate Appendix.
('Includes cost for easements, fee simple, life estates and those costs required for implementation

Table C-15
Preliminary Cost Summary Sheet
Alternative #9
Adaptive Refinement of Authorized Plan

Description	Quantity	Unit	Unit Cost	Extended Cost
Fill Development and Canal Construction				
Blast and Excavate	1,254,446	CY	$3.50	$4,390,560
Crush and Process Rock	1,254,446	CY	$2.00	$2,508,892
Perimeter Levee				
On-site Haul & Place				
1/2 Mile (20%)	88977	CY	$2.00	$177,954
1 Mile (25%)	111221	CY	$2.75	$305,858
2 Miles (25%)	111221	CY	$3.50	$389,274
3 Miles (30%)	133465	CY	$4.50	$600,594
Shape and Compact	444885	CY	$1.40	$622,838
Internal Levee				
On-site Haul & Place				
1/2 Mile (20%)	18750	CY	$2.00	$37,500
1 Mile (25%)	25000	CY	$2.75	$68,750
2 Miles (25%)	25000	CY	$3.50	$87,500
3 Miles (30%)	31250	CY	$4.50	$140,625
Shape and Compact	117832	CY	$1.40	$164,965
Geofabrics				
Geomembrane and nonwoven geotextile(perimeter levee)	1944228	SFT	$0.55	$1,069,325
Woven Geotextile (perimeter and interior levee)	368225	SY	$1.40	$515,515
Roadway				
Fill	1,000	CY	$12.00	$12,000
8" Rock Base	2,224	SY	$8.50	$18,904
2" Wear Surface	1,986	SY	$6.50	$12,909
Conveyance Channel				
S-357A and S-357B Pump Station Discharge	2	EA	$500,000	$1,000,000
Demolition (1)				
Clear and Grub	0	AC	$2,000	$0
Homes (wells, septic, pads etc.)	0	EA	$8,000	$0
Pump Station S-357A (500 cfs)	1	EA	$5,040,000	$5,040,000
Pump Station S-357B (500 cfs)	1	EA	$5,040,000	$5,040,000
Pipeline to C-111, (120-inch-diameter)	2000	LF	$960.00	$1,920,000
Spreader Swale				
Blast and Excavate	62333	CY	$3.50	$218,167
Crush and Process Rock	62333	CY	$2.00	$124,667
Perimeter Levee (Haul, shape, compact)	62333	CY	$4.40	$274,267
Woven Geotextile	82500	SY	$1.40	$115,500
Subtotal Construction				$24,856,564
Contingency (20%)				$4,971,313
Total Construction Cost				$29,827,876
Planning, Engineering, Design, Construction Management (20%)				$5,965,575
Land Acquisition (1)	663	AC		$4,110,200
Total				$39,903,652

(1) Land Acquisition Values are taken from the Real Estate Appendix.

Table C-16

Preliminary Implementation Schedule

	Land Acquisition (Months)(1)	Design (Months) (2)	Permitting (Months) (3)	Construction (Months) (4)	Total Duration (Months)(5)	Completion Date (6)
Alt. 1	**0**	**10**	**8**	**18**	**36**	**Dec 2003**
Alt. 2	**0**	**10**	**8**	**18**	**36**	**Dec 2003**
Alt. 3	**36**	**12**	**8**	**18**	**42**	**June 2004**
Alt. 4	**38**	**0**	**4**	**6**	**42**	**June 2004**
Alt. 5	**30**	**0**	**4**	**6**	**42**	**June 2004**
Alt. 6	**32**	**9**	**8**	**16**	**42**	**June 2004**
Alt. 7	**30**	**10**	**8**	**18**	**42**	**June 2004**
Alt. 8	**34**	**9**	**8**	**18**	**42**	**June 2004**
Alt. 9	**0**	**9**	**8**	**18**	**36**	**Dec 2003**

1. Land acquisition assumes one year to obtain condemnation authority by SFWMD.
2. Design months can occur during land acquisition phase if condemnation authority is available.
3. Permitting can occur during land acquisition and part of permitting.
4. Construction follows design and permitting.
5. Total duration includes overlap for property acquisition with other work efforts.