

Water Preserve Areas Feasibility Study
Selected Plan
hills design region (Hillsboro Impoundment)

Levee, Canals, Earth and Sitework
Submission to EN-C

Original Submission: 28 February 2001

1. Cost estimates are needed for design features associated with the Hillsboro Impoundment within the Water Preserve Areas (WPA) Feasibility Study. This cost estimate will be used as the Selected Plan in the study.
2. The point of contact for this request is Mr. Keith Jones, at extension 1127. Let me know if I can be of more assistance.

Attachments Provided:

1. Spreadsheet Analysis Report (revised) - 3 pages
2. Geotechnical Data and Assumptions (revised) - 3 pages
3. 11" x 17" Layout Drawings - 2 pages
 - Site Layout (xsect.dgn) - shows design
 - Alignments/Locations (levee.dgn)(revised) - shows levee and canal centerlines, cross section location, distances and areas used for calculation
4. 8½" x 11" Drawing - 1 page of Hillboro Embankment Design
5. Cross Section Profiles - 6 pages
6. C-11 Design Region Scope - 2 pages
 - Contains a comprehensive list of design and cost feature

**Water Preserve Areas Feasibility Study
Levees and Canals Summary of Material Quantities
Hillsboro Impoundment and Design Region**

	Gross Volume cu-yds	Rock Volume cu-yds	Overburden Volume cu-yds	InRoads Volume cu-yds
Excavated Materials				
Conveyance or Seepage Canals	683095	382724	300371	
F&W Littoral Shelves	76991	0	76991	
Intake and Discharge Basins (See Note 1)	84841	43414	41428	
Totals	844928	426138	418789	
Amount reusable=	70%	591449	298297	293153
Amount spoil=	30%	253478	127841	125637
Quality Construction Material Required				
Fill Material Requirements	1265787	see Note 1	674840	
Revetment - 12" Bedding Stone	9532			
Revetment - 18" Rip Rap	18598			
Spoil Material Disposal Areas				
Wind Breaks	0			
Borrow Pits/Mined Lakes	2149615			
Fill Areas	0			
Totals	2149615			
Spoil Material Generated				
Excavated Materials	253478			
Totals	253478			

Notes:

Note 1: Mined Lake Areas 1N and 4S need to be brought up to grade because of levee alignment over the area.

**Water Preserve Areas Feasibility Study
Levees and Canals Summary of Material Quantities
Hillsboro Impoundment and Design Region**

Excavation Requirements

Rock at Elevation = 5.0 ft-NGVD and below

Conveyance or Seepage Canals	Length feet	Inside Slope 1V on ?H	Outside Slope 1V on ?H	Bottom Width feet	Average Ground ft-NGVD	Canal Invert ft-NGVD	Canal Cut Depth feet	Cross Section Area sqft	Gross Volume cu-yds	Rock Volume cu-yds	Overburden Volume cu-yds
Southern Impoundment - C-508S											
Eastern Boundary	2435	3.0	3.0	25.0	9.6	-5.0	14.6	1004	90589	49602	40987
Southern Boundary	7160	3.0	3.0	25.0	9.7	-5.0	14.7	1016	269367	145852	123515
Totals	17330								614604	295722	318882
Hillsboro Canal Improvement	24990	2.0	2.0	16.0	10.0	-9.0	19.0	1026	949620	570142	379478
Existing Hillsboro Canal	24990	2.0	2.0	40.0	10.0	-4.0	14.0	952	881129	483140	397989
Total from Hillsboro Improvement	24990								68491	87002	-18511
Totals	42320								683095	382724	300371

F&W Littoral Shelves	Length feet	Width feet	Area Acres	Average Ground ft-NGVD	Invert ft-NGVD	Cut Depth feet	Cross Section Area sqft	Gross Volume cu-yds	Rock Volume cu-yds	Overburden Volume cu-yds
Southern Impoundment - C-508S										
Eastern Boundary	2435	30.0	1.7	9.6	6.0	3.6	108	9740	0	9740
Southern Boundary	7160	30.0	4.9	9.7	6.0	3.7	111	29436	0	29436
Totals	17330		11.9					76991	0	76991

Intake and Discharge Basins	Area sqft	Area Acres	Average Ground ft-NGVD	Invert ft-NGVD	Cut Depth feet	Gross Volume cu-yds	Rock Volume cu-yds	Overburden Volume cu-yds
S-526A Intake	4860	0.1	8.7	4.0	4.7	846	180	666
S-525A Discharge	86795	2.0	8.5	4.0	4.5	14466	3215	11251
S-525B Discharge	86795	2.0	10.5	4.0	6.5	20895	3215	17680
Totals		5.7				84841	43414	41428

**Water Preserve Areas Feasibility Study
Levees and Canals Summary of Material Quantities
Hillsboro Impoundment and Design Region**

Fill Material Requirements											
Levees	Length feet	Inside Slope 1V on ?H	Outside Slope 1V on ?H	Top Width feet	Average Ground ft-NGVD	Top of Levee ft-NGVD	Levee Height feet	Cross Section Area sqft	Gross Volume cu-yds	InRoads Length cu-yds	InRoads Volume cu-yds
Northern Impoundment L-508N											
Eastern Boundary	8005	3.0	3.0	12	11.4	24.0	12.6	627	186036		
Southern Boundary, East of S-525A	8195	3.0	3.0	12	11.1	24.0	12.9	654	198510		
Southern Boundary, West of S-525A	7565	3.0	3.0	12	10.2	24.0	13.8	737	206474		
Internal Levee L-508I	6315	3.0	3.0	12	10.1	22.0	11.9	568	132762		
Northern Impoundment Totals	30080								723783		
Southern Impoundment L-508S											
Northern Boundary	7485	3.0	3.0	12	10.7	24.0	13.3	690	191358		
Eastern Boundary	2300	3.0	3.0	12	9.6	24.0	14.4	795	67712		
Southern Boundary	8945	3.0	3.0	12	9.7	24.0	14.3	785	260091		
Western Boundary	4145	3.0	3.0	12	12.6	24.0	11.4	527	80855		
Existing Western Boundary, L-36	4145	3.0	3.0	12	12.6	22.0	9.4	378	58012		
Southern Impoundment Totals	22875								542005		
Totals	52955								1265787.36		
NOTE: Existing Western Boundary, L-36 is subtracted from fill requirement for L-508S Western Boundary because L-36 will be raised.											
Revetment	12" Bedding Stone					Rip Rap					
	Length feet	Width feet	Area acres	Depth feet	Gross Volume cu-yds	Length feet	Width feet	Area acres	Depth feet	Gross Volume cu-yds	
Northern Impoundment L-508N											
	1600	26.6	1.0	1.0	1576	1600	34.6	1.3	1.5	3076	
	1000	26.6	0.6	1.0	985	1000	34.6	0.8	1.5	1922	
	1375	26.6	0.8	1.0	1355	1375	34.6	1.1	1.5	2643	
	1000	26.6	0.6	1.0	985	1000	34.6	0.8	1.5	1922	
Southern Impoundment L-508S											
	1000	26.6	0.6	1.0	985	1000	34.6	0.8	1.5	1922	
	1000	26.6	0.6	1.0	985	1000	34.6	0.8	1.5	1922	
	1000	26.6	0.6	1.0	985	1000	34.6	0.8	1.5	1922	
	1700	26.6	1.0	1.0	1675	1700	34.6	1.4	1.5	3268	
Totals	9675		5.9		9532	9675		7.7		18598	
Wind Breaks	Length feet	Inside Slope 1V on ?H	Outside Slope 1V on ?H	Top Width feet	Average Ground ft-NGVD	Top of Levee ft-NGVD	Levee Height feet	Cross Section Area sqft	Gross Volume cu-yds		
Totals	0							0	0	0	
Borrow Pits/Mined Lakes	Area sqft	Area acres	Bottom Depth ft-NGVD	Finished Depth ft-NGVD	Fill Depth feet	Gross Volume cu-yds					
#1N	86180	2.0	-20.0	10.2	30.2	96394					
#2N	1004170	23.1	-20.0	4.0	24.0	892596					
#3N	39935	0.9	-20.0	4.0	24.0	35498					
#1S	113190	2.6	-20.0	4.0	24.0	100613					
#2S	115530	2.7	-20.0	4.0	24.0	102693					
#3S	314920	7.2	-20.0	4.0	24.0	279929					
#4S	525860	12.1	-20.0	9.7	29.7	578446					
L-36 Borrow Canal	285510	6.6	4.0	10.0	6.0	63447					
Totals		57.1				2149615					
Fill Areas	Length feet	Width feet	Area sqft	Area acres	Average Ground ft-NGVD	Finished Height ft-NGVD	Fill Depth feet	Gross Volume cu-yds			
Totals	0			0.0			0.0	0	0		

*** Geotechnical Data and Assumptions to Use for
Feasibility Level Cost Estimates (Amended 2/22/01)

Design Region: hills

Compaction Factor for Sandy Overburden:
Answer: 0.85

Swell Factor for Sandy Overburden:
Answer: 1.10

Compaction Factor for Rock:
Answer: 0.85

Swell Factor for Rock:
Answer: 1.30

Material Makeup of Levee Embankment:

Answer: Crushed rock from Canals/Fish refugia. This material must be crushed to a maximum particle size of 3 inches or less in order to utilize for levee construction. The rock will also need to be processed to produce a well-graded material for dam construction. Material may also be utilized from the sand and gravel overburden excavated for the seepage canals/Fish refugia. A majority of the material will be excavated from the adjacent Hillsboro Canal or eastern seepage canal. **It is estimated that overburden exists from ground surface to elevation +5. From +5 to elevation -5 feet NGVD soft limestone bedrock will be encountered with intermittent Sand lenses. At elevation -5 feet NGVD to elevation -30 feet, mostly sand with some gravel is in place. Below elevation -30 feet, hard sandy limestone is encountered.**

Special Levee Construction Design Criteria:

Foundation Treatment:

Answer: Remove top 18 inches of overburden for levee width. In addition, assume 1% of levee length requires removal of 36 inches of overburden.

Seepage Control

Answer: None

*** Assumptions based upon limited subsurface information and prior projects, as of 2/21/01

Slope Protection:

Answer: Protect 26.6 feet of upstream levee slope for approximately 9675 feet of levee perimeter (See Cross-Section hand carried to EN-H which includes 12 inches bedding stone plus 18 inches of rip rap from toe to elevation 18.4 ft NGVD +/-). Rip Rap to be placed in strategic locations including sharp corners, bends, and areas of long wind fetch. Hand drawing showing approximate locations was delivered to EN-H on 2/27/01. Use excess limestone from onsite excavations if available. Otherwise import limestone. Remaining 75% of upstream embankment perimeter will be grassed for erosion protection. See hand delivered drawing for estimated locations of rip rap.

Where the material will come from?

Answer: Material for the Hillsboro Impoundment will be obtained from:

1. Usable excavated material from adjacent seepage canals
2. Limited excavation within the impoundment
3. Usable excavated material from improvement of Hillsboro canal

Notes:

When constructing the levee, the Contractor will be required to utilize 12 inch lifts which then will be compacted down to 10 to 11 inches. Compaction requirements will be to 98% maximum dry density based upon standard proctor compaction tests or a nuclear density meter. Also, control of excessive moisture shall be the responsibility of the Contractor.

Excavation Procedure/Technique and/or Blasting Requirements (at this location only):

Answer: Assume some blasting of rock will be required (Rios from EN-G will supply blasting patterns/plan). After initial rock blasting some additional ripping will be required with backhoe with ripper attachment. Following blasting and ripping, normal excavation equipment may be utilized.

Percentage of Usable Excavated Overburden Soil Material:

Answer: Assume 70% of the material can be reused. The remaining 30% should be disposed of onsite or at an approved disposal area. Using excess unsuitable material to build wind breaks, boat ramps or to flatten interior slopes is recommended also. The distribution of overburden soil versus rock is detailed above in red.

Percentage of Usable Excavated Rock Material:

Answer: Assume 70% of the material can be reused. The remaining 30% should be disposed of onsite or at an approved disposal area. Using excess unsuitable material to build wind breaks, boat ramps or to flatten interior slopes is recommended also. The distribution of overburden soil versus rock is detailed above in red.

Other Considerations:

A rock crushing plant will be setup within the impoundment to process excavated material prior to placement.

Assume overburden soils have a unit weight of 115 pcf while limestone has unit weight of 145 pcf for hauling purposes.

Geotechnical Instrumentation:

NOTE: This instrumentation is required for monitoring and operational safety of project features within the design region.

1. Shallow Depth Piezometers (\pm 5.0 feet from natural grade)

Answer: Assume 3 piezometers will be included.

2. Medium Depth Piezometers (greater than 5.0 and less than 50 feet from natural grade) - Assume 10 piezometers will be included.

3. Deep Depth Piezometers (greater than 50 feet from natural grade) - Assume 3 piezometers will be included.

4. Inclinometers - Assume 1 constructed through final embankment downstream slope down to hard limestone. Locate on east section adjacent to housing development.

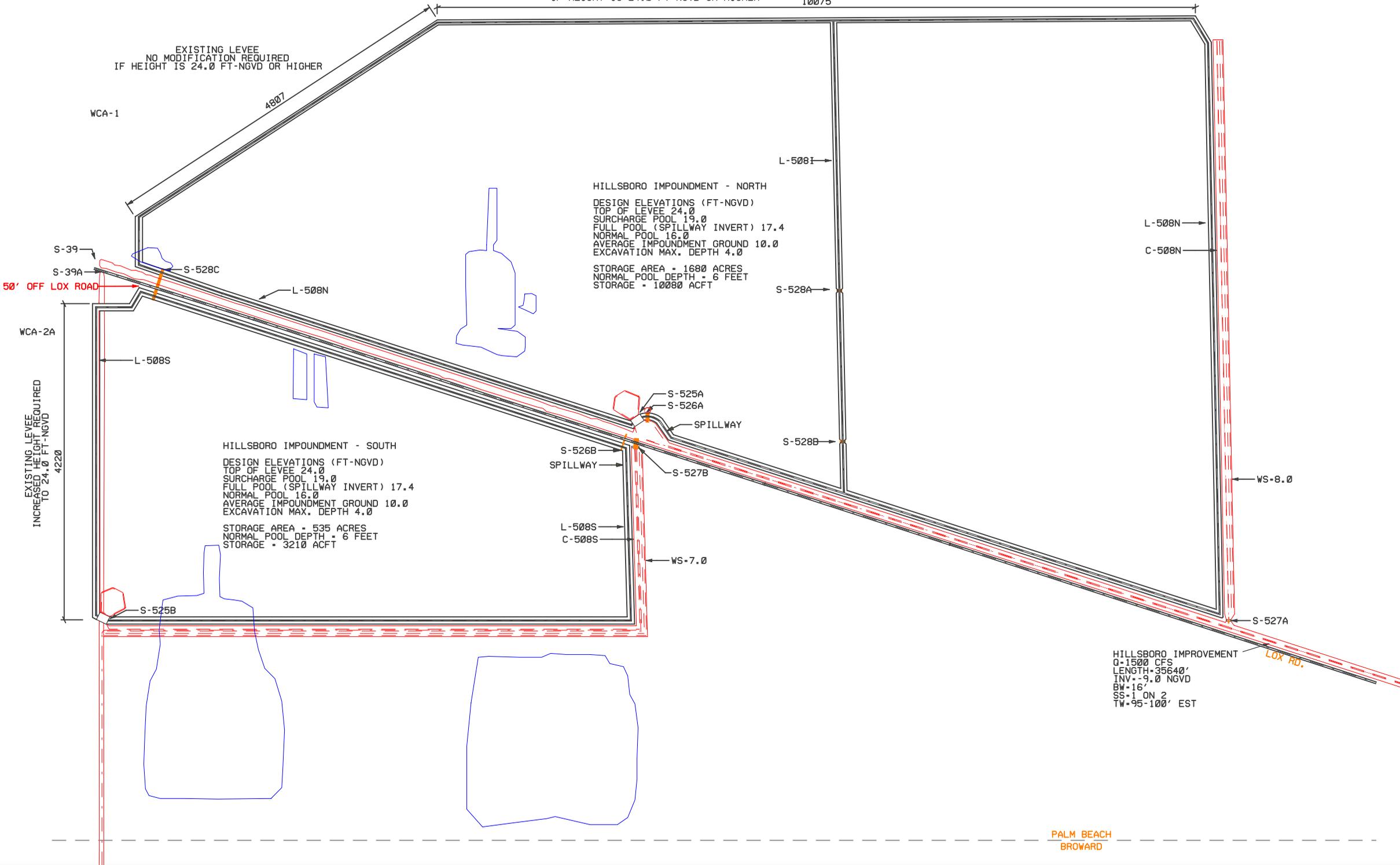
EXISTING LEVEL
NO MODIFICATION REQUIRED
IF HEIGHT IS 24.0 FT-NGVD OR HIGHER 10075

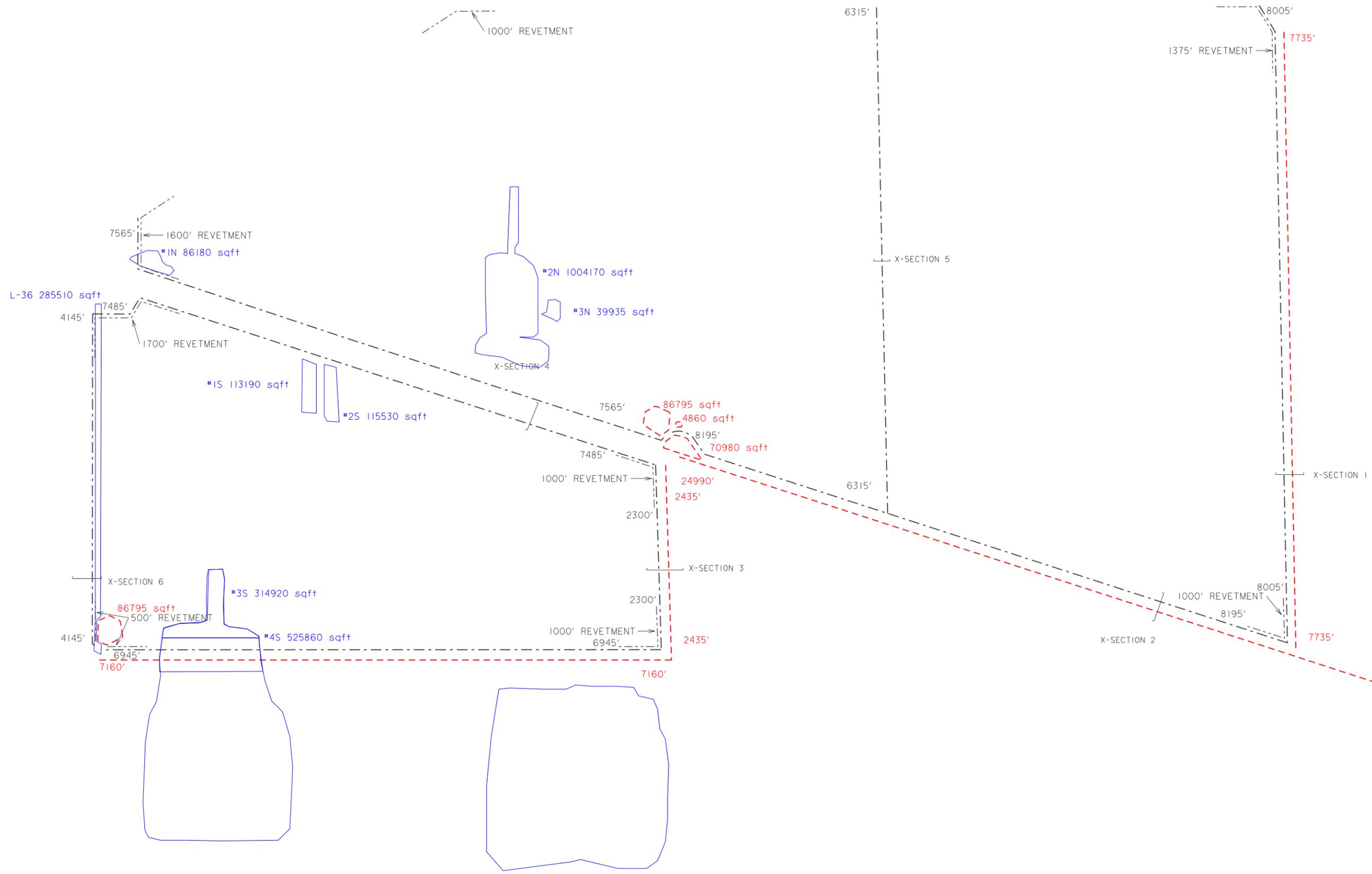
EXISTING LEVEL
NO MODIFICATION REQUIRED
IF HEIGHT IS 24.0 FT-NGVD OR HIGHER

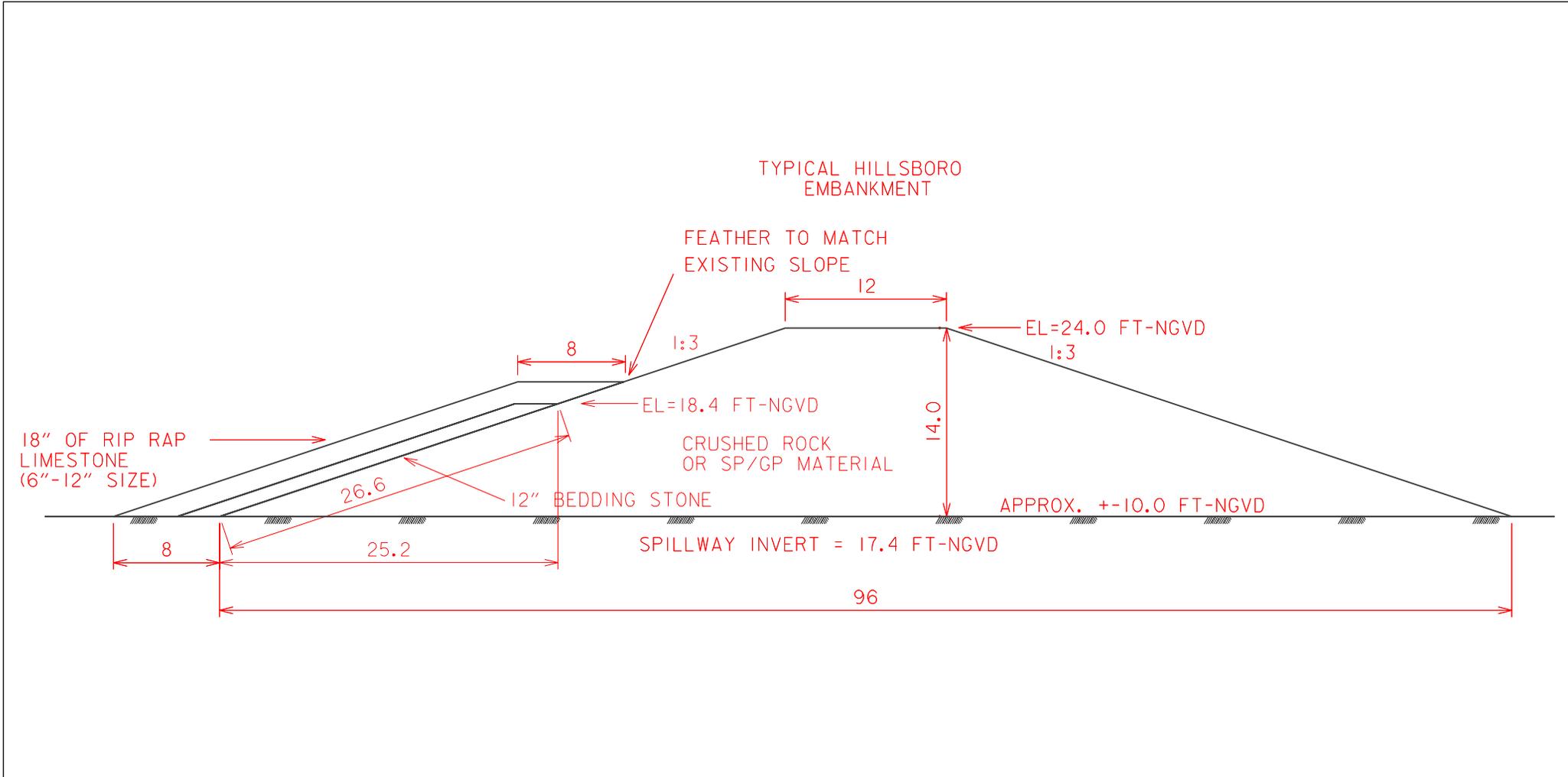
HILLSBORO IMPOUNDMENT - NORTH
DESIGN ELEVATIONS (FT-NGVD)
TOP OF LEVEE 24.0
SURCHARGE POOL 19.0
FULL POOL (SPILLWAY INVERT) 17.4
NORMAL POOL 16.0
AVERAGE IMPOUNDMENT GROUND 10.0
EXCAVATION MAX. DEPTH 4.0
STORAGE AREA = 1680 ACRES
NORMAL POOL DEPTH = 6 FEET
STORAGE = 10080 ACFT

HILLSBORO IMPOUNDMENT - SOUTH
DESIGN ELEVATIONS (FT-NGVD)
TOP OF LEVEE 24.0
SURCHARGE POOL 19.0
FULL POOL (SPILLWAY INVERT) 17.4
NORMAL POOL 16.0
AVERAGE IMPOUNDMENT GROUND 10.0
EXCAVATION MAX. DEPTH 4.0
STORAGE AREA = 535 ACRES
NORMAL POOL DEPTH = 6 FEET
STORAGE = 3210 ACFT

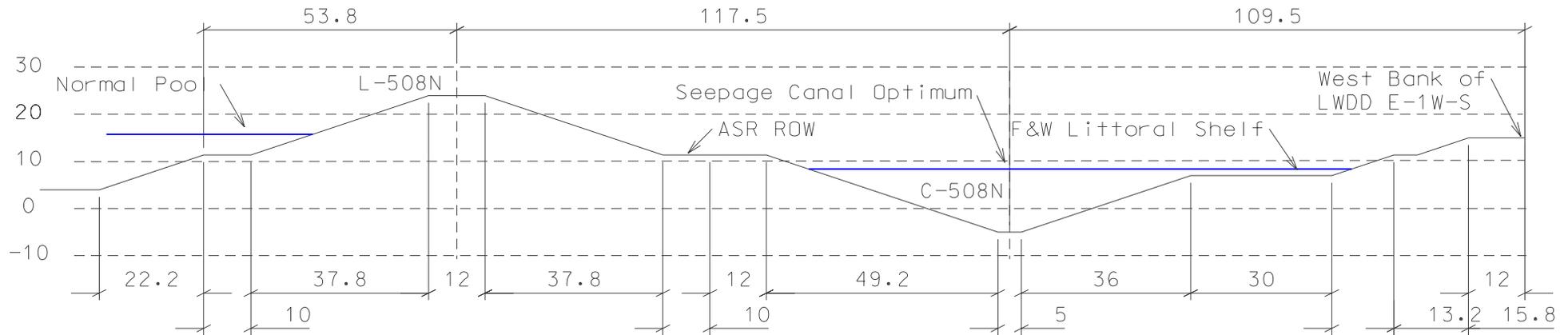
HILLSBORO IMPROVEMENT
Q-1500 CFS
LENGTH-35640'
INV.-9.0 NGVD
BW-16'
SS-1 ON 2
TW-95-100' EST







X-section 1
Hillsboro North Impoundment
Eastern Boundary
Looking North

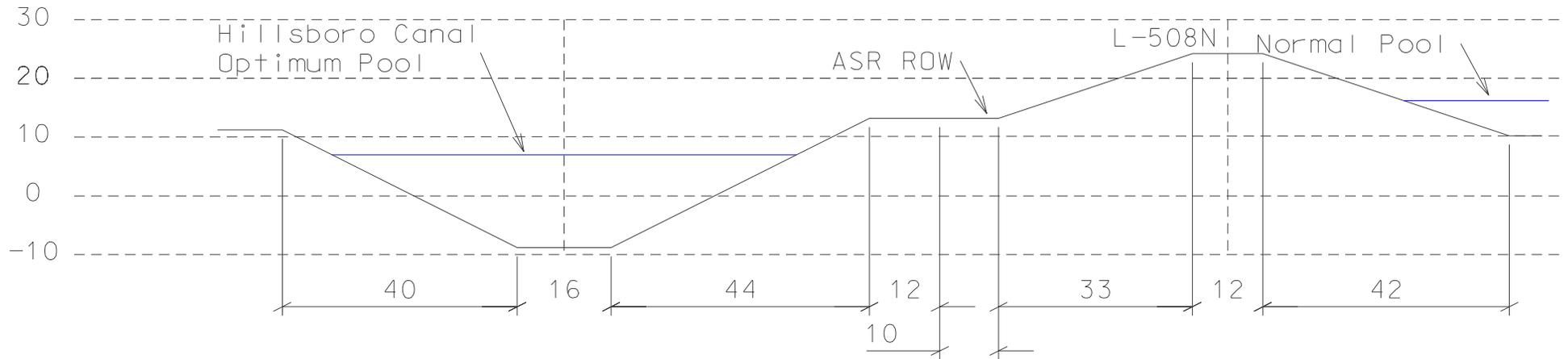


Design Elevations (ft-NGVD)
Top of Levee 24.0
Surcharge Pool 19.0
Full Pool (Spillway Invert) 17.4
Normal Pool 16.0
Top of West Bank of LWDD E-1W-S 15.0
Average Local Ground 11.4
Average Impoundment Ground 10.0
Seepage Canal Optimum 8.5
F&W Littoral Shelf 7.0
Excavation Max. Depth 4.0
Seepage Canal Bottom -5.0

Preliminary Design Slopes
Outside Levee Slope = 1V:3H
Inside Levee Slope = 1V:3H
Seepage Canal Slope = 1V:3H

10' set aside for ASR ROW at
outside toe of impoundment levee

X-section 2
Hillsboro North Impoundment
Southern Boundary
Looking West

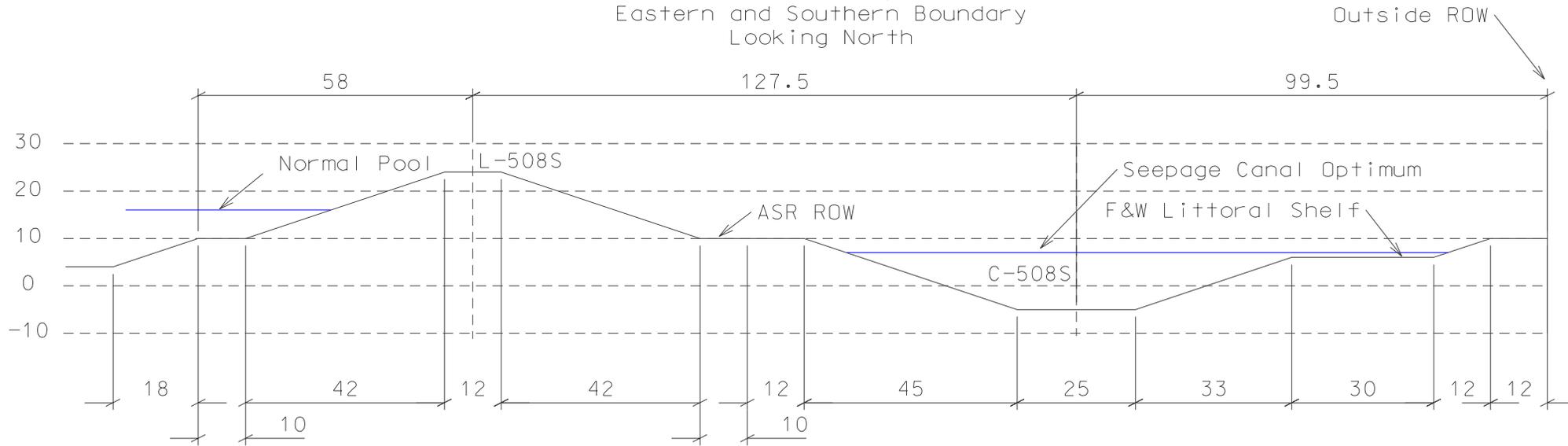


Design Elevations (ft-NGVD)
Top of Levee 24.0
Surcharge Pool 19.0
Full Pool (Spillway Invert) 17.4
Normal Pool 16.0
Outside Toe of Levee 13.0
Average Local Ground 9.0-11.0
Average Impoundment Ground 10.0
Hillsboro Canal Optimum Pool 7.0-8.0
Excavation Max. Depth 4.0
Hillsboro Canal Bottom -9.0

Preliminary Design Slopes
Levee Slope = 1V:3H
Hillsboro Canal Slope = 1V:2H

10' set aside for ASR ROW at
outside toe of impoundment levee

X-section 3
Hillsboro South Impoundment
Eastern and Southern Boundary
Looking North

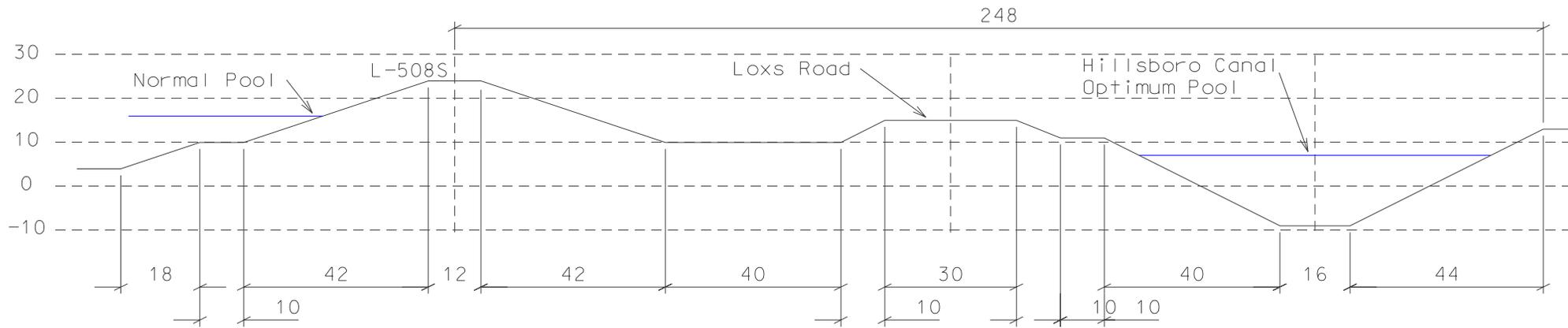


Design Elevations (ft-NGVD)
Top of Levee 24.0
Surcharge Pool 19.0
Full Pool (Spillway Invert) 17.4
Normal Pool 16.0
Average Impoundment Ground 10.0
Seepage Canal Optimum 7.0
F&W Littoral Shelf 6.0
Excavation Max. Depth 4.0
Seepage Canal Bottom -5.0

Preliminary Design Slopes
Outside Levee Slope = 1V:3H
Inside Levee Slope = 1V:3H
Seepage Canal Slope = 1V:3H

10' set aside for ASR ROW at
outside toe of impoundment levee

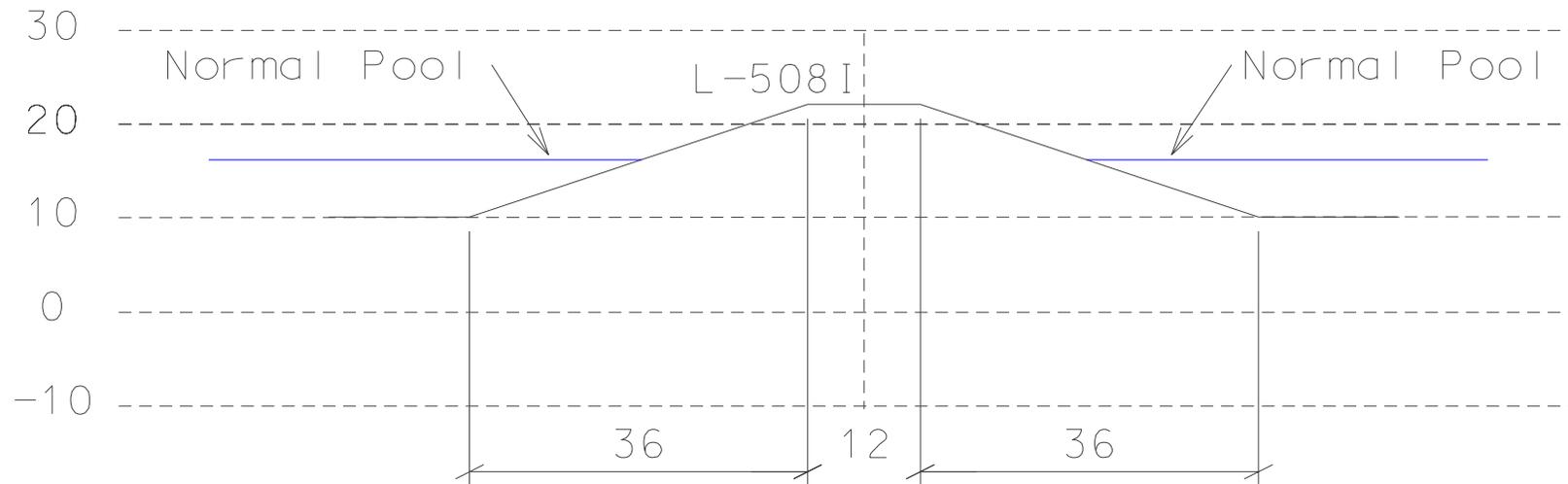
X-section 4
Hillsboro South Impoundment
Northern Boundary
Looking West



Design Elevations (ft-NGVD)
Top of Levee 24.0
Surcharge Pool 19.0
Full Pool (Spillway Invert) 17.4
Normal Pool 16.0
Loxs Road 15.0
North Bank of Hillsboro Canal 13.0
Average Local Ground 9.0-11.0
Average Impoundment Ground 10.0
Hillsboro Canal Optimum Pool 7.0-8.0
Excavation Max. Depth 4.0
Hillsboro Canal Bottom -9.0

Preliminary Design Slopes
Outside Levee Slope = 1V:3H
Inside Levee Slope = 1V:3H
Hillsboro Canal Slope = 1V:2H

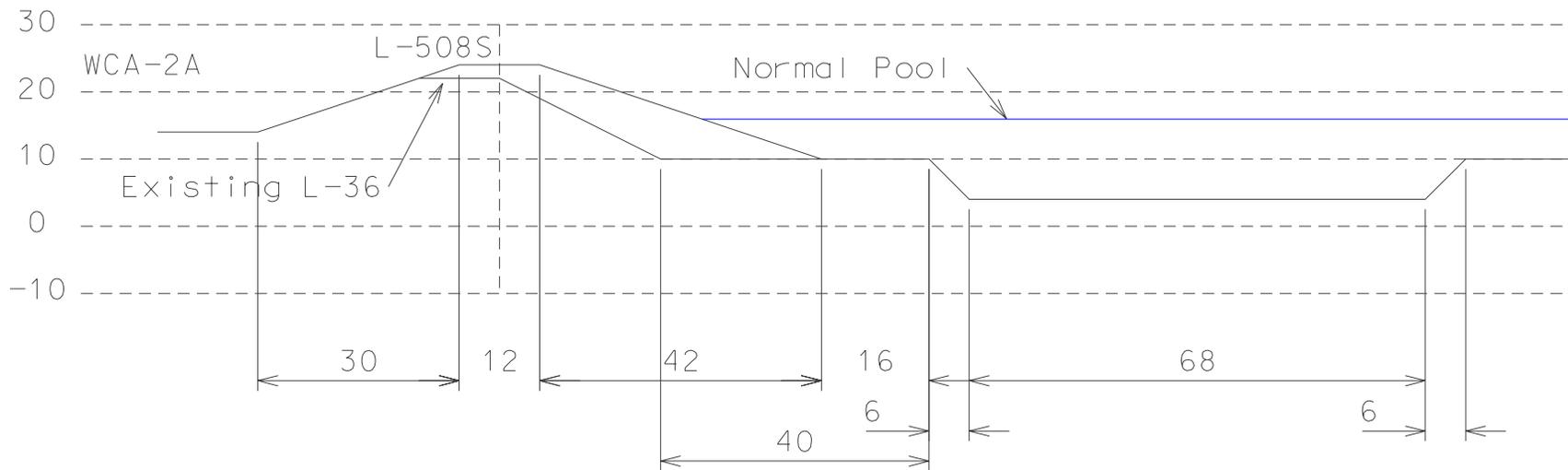
X-section 5
 Hillsboro North Impoundment
 Internal Compartment Levee
 Looking North



Design Elevations (ft-NGVD)
 Top of Levee L-508 I 22.0
 Surcharge Pool 19.0
 Full Pool (Spillway Invert) 17.4
 Normal Pool 16.0
 Outside Toe of Levee 13.0
 Average Local Ground 9.5-10.5
 Average Impoundment Ground 10.0
 Excavation Max. Depth 4.0

Preliminary Design Slopes
 Levee Slope = 1V:3H

X-section 6
Hillsboro South Impoundment
Western Boundary
Looking North



Design Elevations (ft-NGVD)
Top of Levee L-508S 24.0
Top of Levee L-36 22.0
Surcharge Pool 19.0
Full Pool (Spillway Invert) 17.4
Normal Pool 16.0
Average Local Ground 9.0-11.0
Average Impoundment Ground 10.0
Excavation Max. Depth 4.0
L-36 Canal Bottom 4.0

Preliminary Design Slopes
Outside Levee Slope = 1V:3H
Inside Levee Slope = 1V:3H
Inside Levee Slope of L-36 = 1V:2H

Design Region: hills (Hillsboro Impoundment)

Design:

- a) Design levees and seepage canals for 6' deep compartmentalized impoundment. Consider future ASR systems retrofit in design. Provide revetment for inside slope protection where sharp corners occur.
- b) Design gated spillway and a pump station for a 6' deep impoundment.
- c) Design gated culvert structures for seepage control and compartment water level control.
- d) Design conveyance improvements for the Hillsboro Canal to the LWDD E-1 canal (US-441).
- e) Determine if conveyance improvements for the C-536 canal (L-36 borrow canal) will be needed to handle 500 cfs North Springs Irrigation District (NSID) flows.
- f) Minor clearing and grubbing within impoundment.

Hillsboro Impoundment - North

Design Elevations (Ft-NGVD)
Top Of Levee 24.0
Surcharge Pool 19.0
Full Pool (Spillway Invert) 17.4
Normal Pool 16.0
Average Impoundment Ground 10.0
Excavation Max. Depth 4.0

Storage Area = 1680 Acres
Normal Pool Depth = 6 Feet
Storage = 10080 Acft

Hillsboro Impoundment - South

Design Elevations (Ft-NGVD)
Top Of Levee 24.0
Surcharge Pool 19.0
Full Pool (Spillway Invert) 17.4
Normal Pool 16.0
Average Impoundment Ground 10.0
Excavation Max. Depth 4.0

Storage Area = 535 Acres
Normal Pool Depth = 6 Feet
Storage = 3210 Acft

Pumps:

1. S-525A Northern impoundment inflow pump
2. S-525B Southern impoundment inflow pump

Gated Culverts:

1. S-526A Northern impoundment discharge control structure
2. S-526B Southern impoundment discharge control structure
3. S-527A Northern impoundment seepage control structure
4. S-527B Southern impoundment seepage control structure
5. S-528A Northern impoundment compartment level control structure
6. S-528C Control structure to allow discharges between northern and southern compartments

Un-gated Culverts:

1. S-528B Weir Control - Northern impoundment compartment level control structure

Levees:

1. L-508N Northern impoundment levee
2. L-508S Southern impoundment levee
3. L-508I Northern internal compartment levee

Canals:

1. C-508N Northern impoundment seepage canal on eastern boarder
2. C-508S Southern impoundment seepage and conveyance canal
3. C-536 Improved L-36 borrow

Utilities:

1. Phone and electric