Port of Seattle

July 31, 2001

Ms. Ann E. Kenny
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

Dear Ms. Kenny:

SUBJECT: Conceptual Drawing for Flow Impact Offset Facility

Enclosed are several conceptual drawings relating to the proposed Flow Impact Offset Facility for Seattle-Tacoma International Airport. The drawings show some of the details discussed at the low flow technical meetings.

Please call me at 206/988-5528 if you have any questions.

Sincerely,

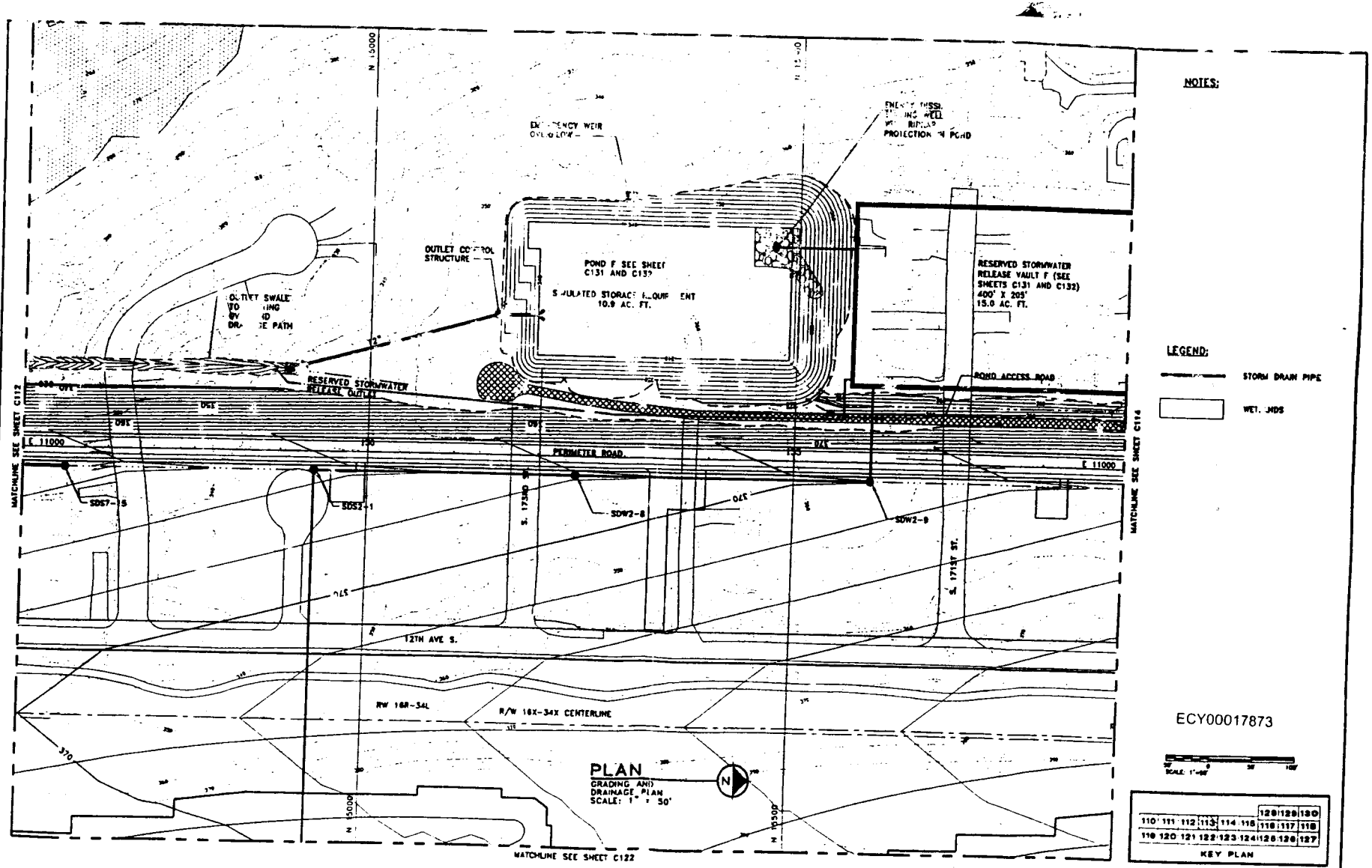
Keith R. Smith
Water Resources Manager

Attachments

c: Kelly Whiting, KCDNR

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

RESERVE STORMWATER
RELEASE STORAGE DRAWINGS



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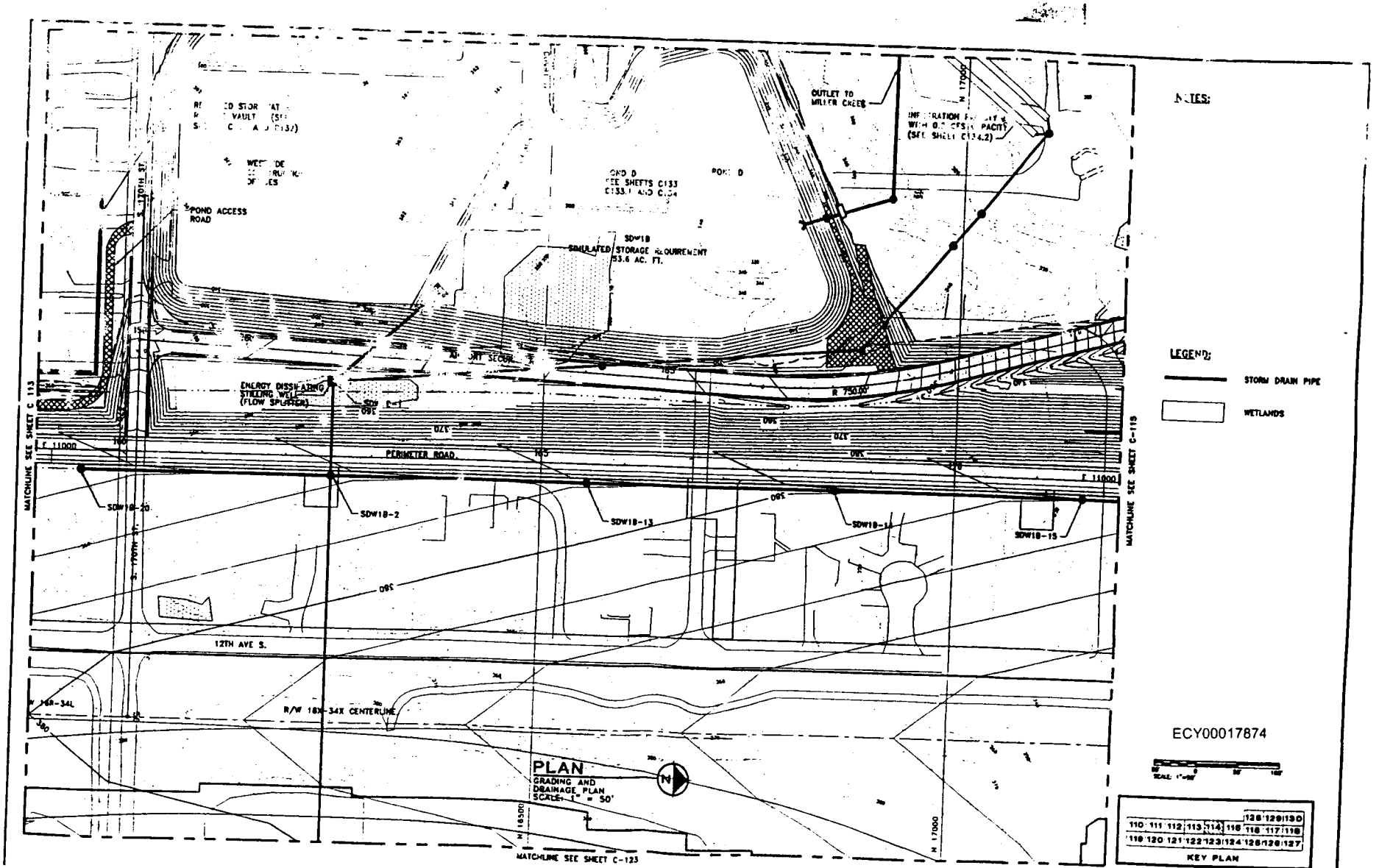
AR 029227



AR 029228

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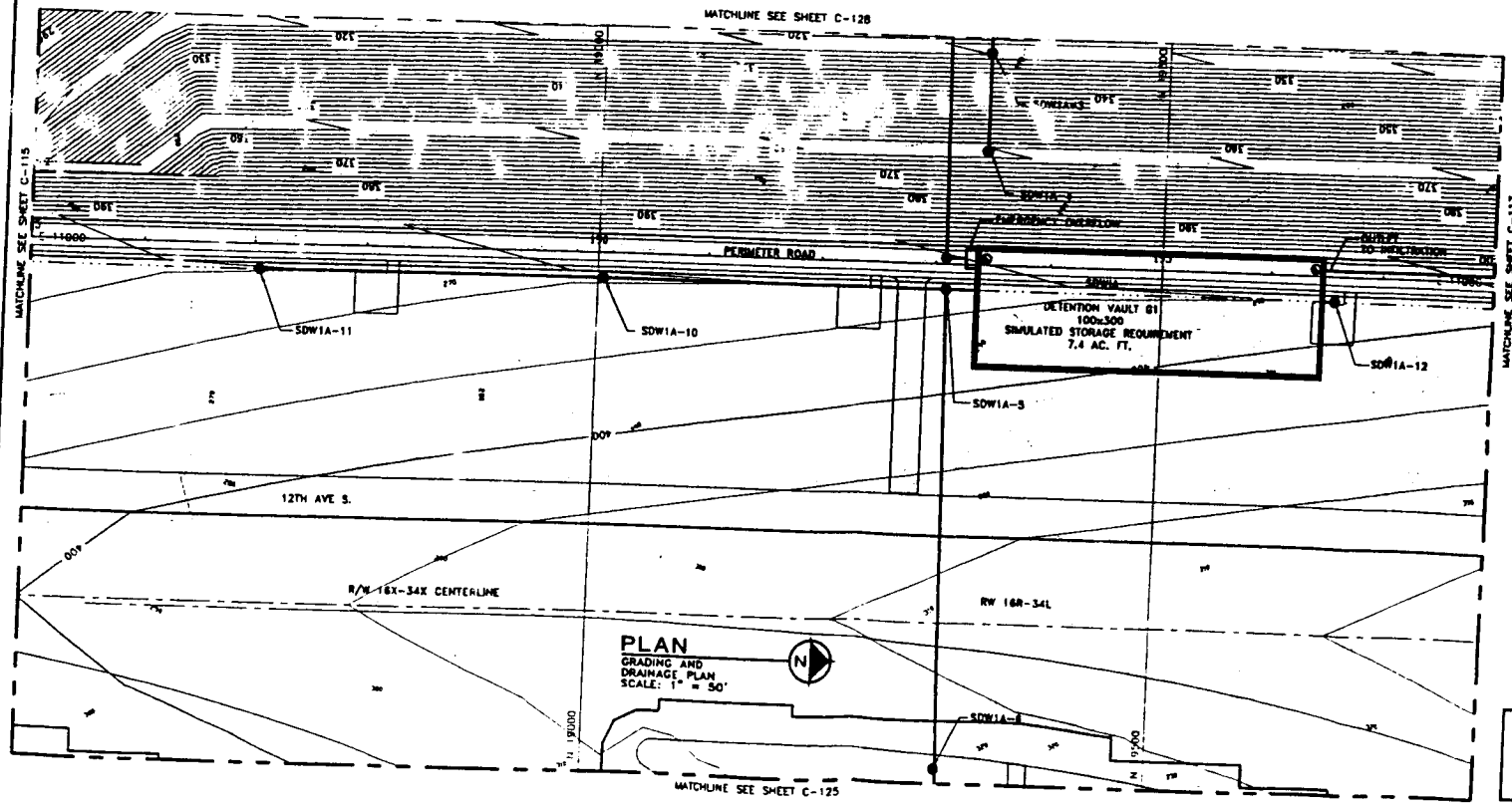


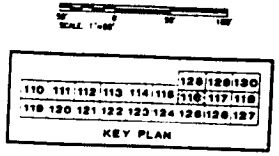
NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

ECY00017875



Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

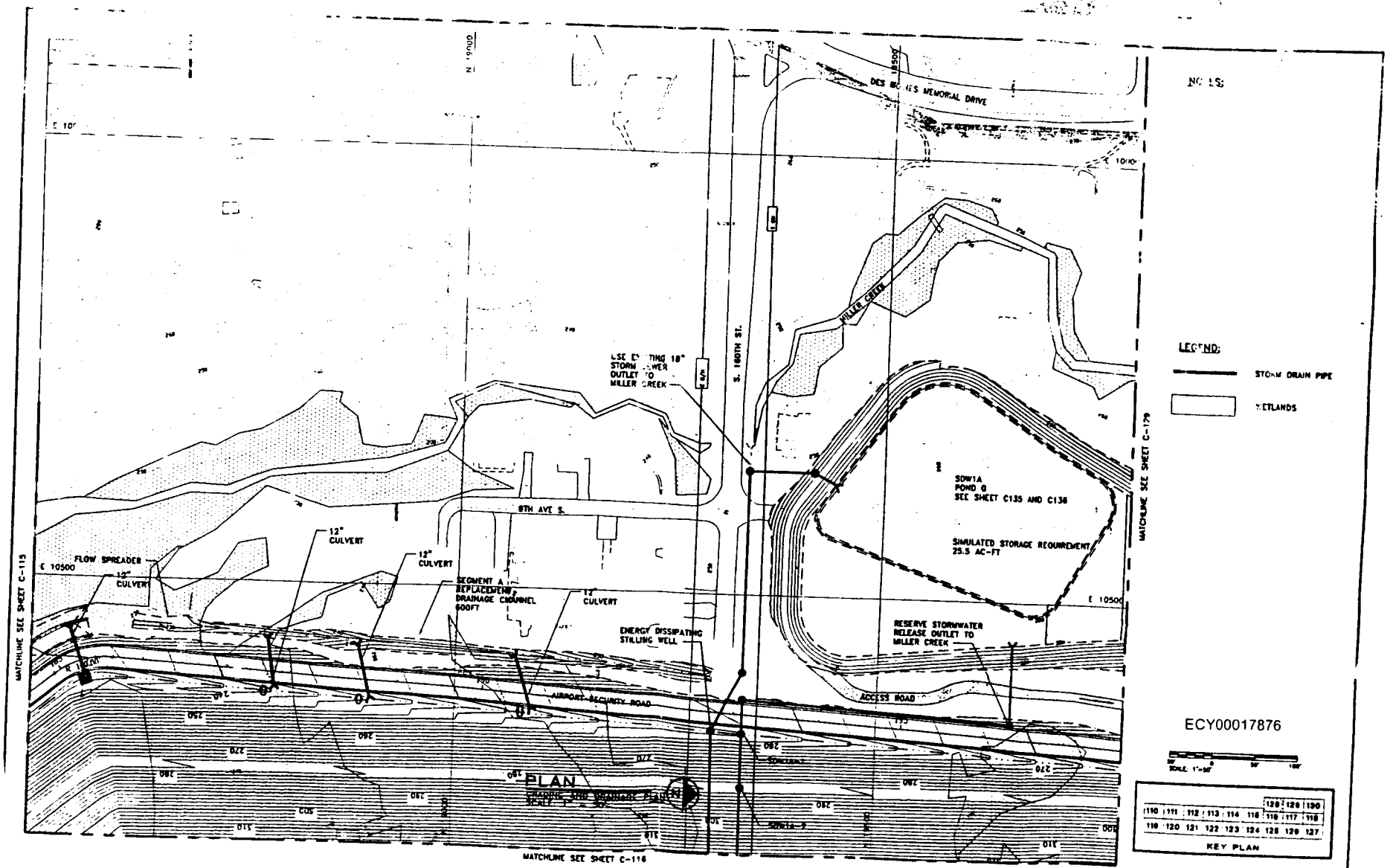
THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

GRADING AND DRAINAGE PLAN

JULY 30, 2001

EXHIBIT C116

AR 029229



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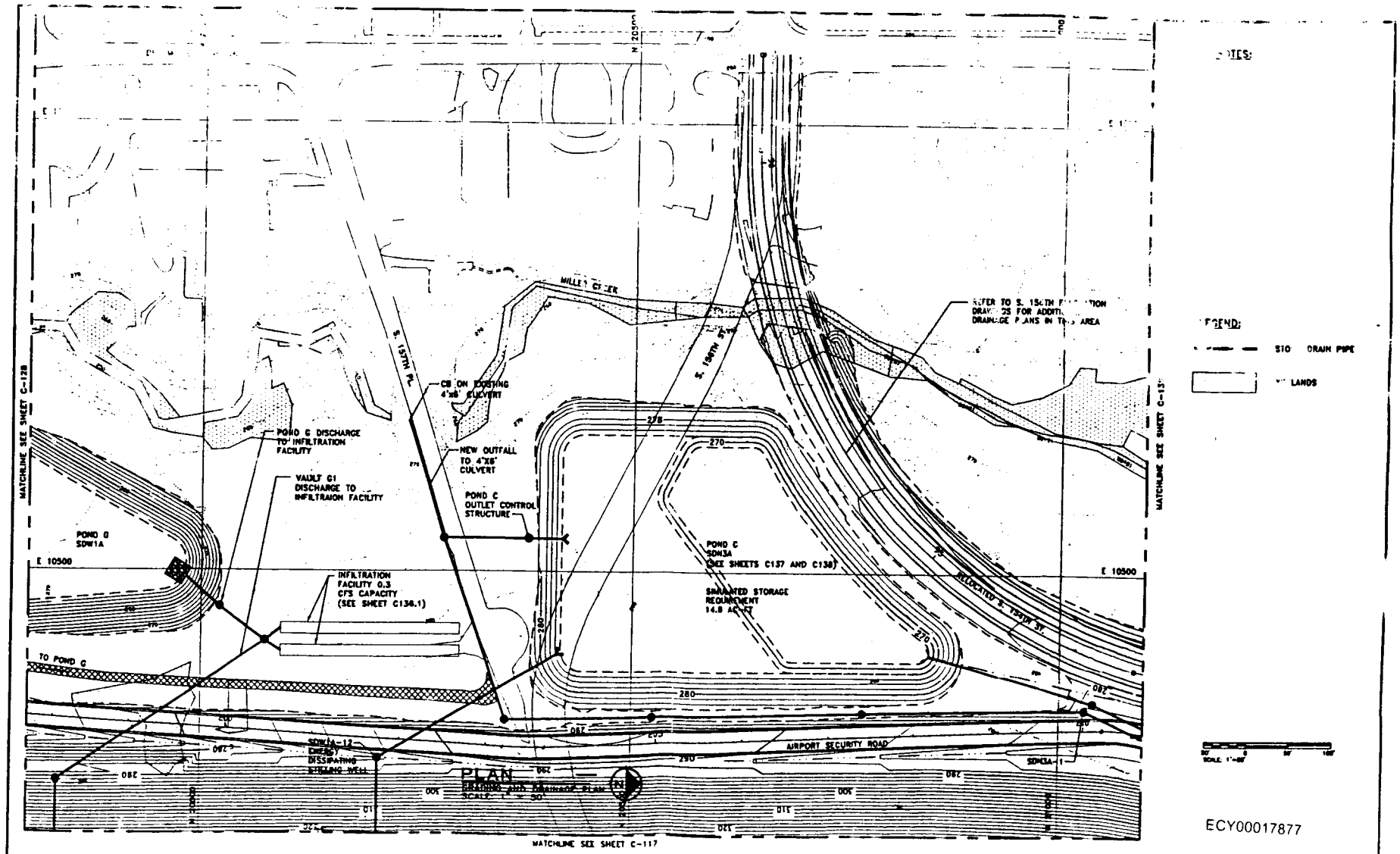

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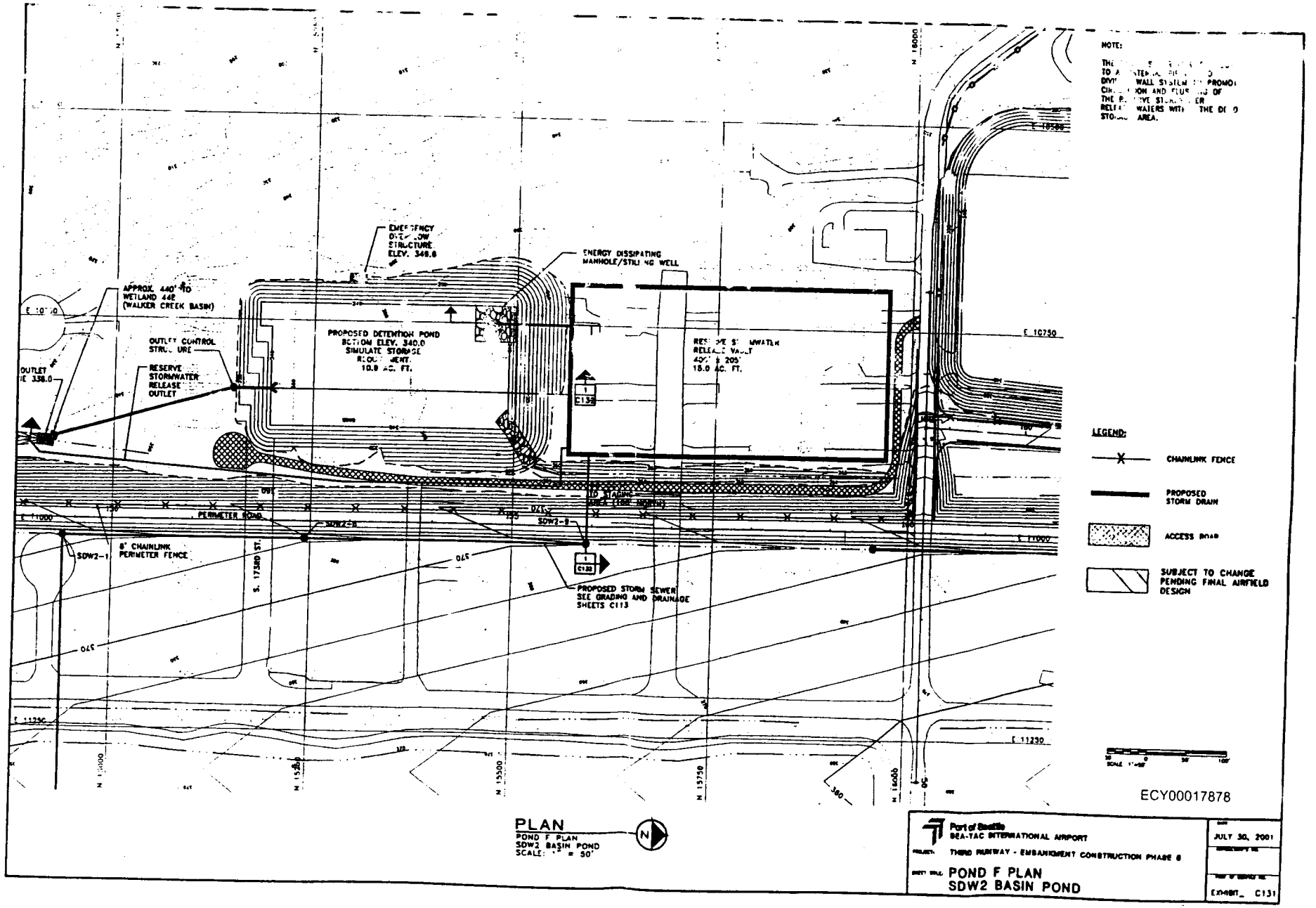

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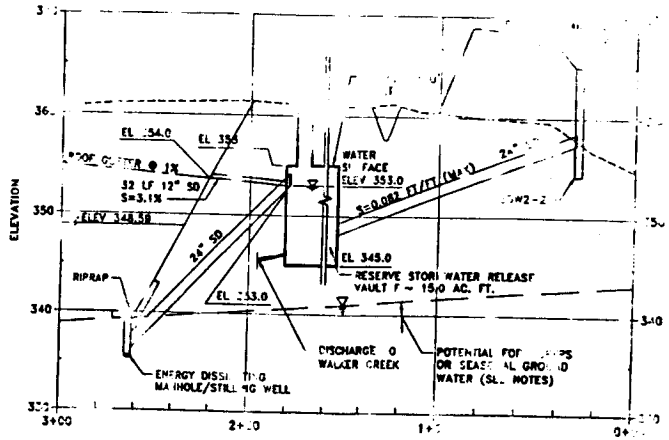
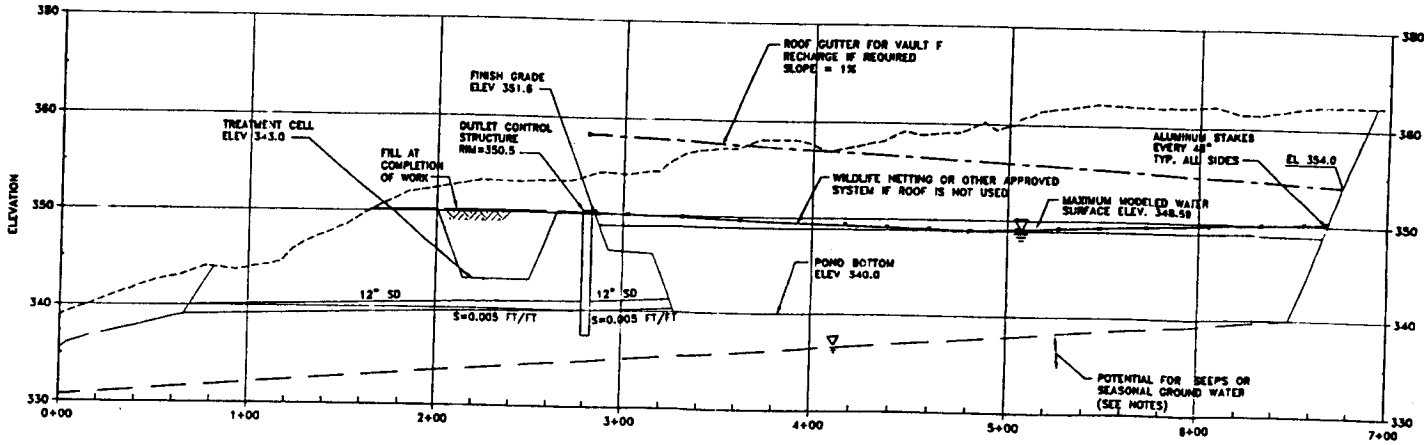


PROFILE
STORM DRAIN AND RESERVE
STORMWATER RELEASE VAULT PROFILE
SCALE: HORZ 1" = 30'
VERT 1" = 6'
1
C131

1. ... ELEVATIONS ARE APPROXIMATE BASED ... GEOTECHNICAL INVESTIGATIONS AN... ELEVATION WILL BE INCLUDED AS PART ... DESIGN ANALYSIS.

2. ... POND CONFIGURATION MAY VARY TO MAINTAIN ... STORM WATER STORAGE ABOVE THE OBSERVED GROUND WATER.

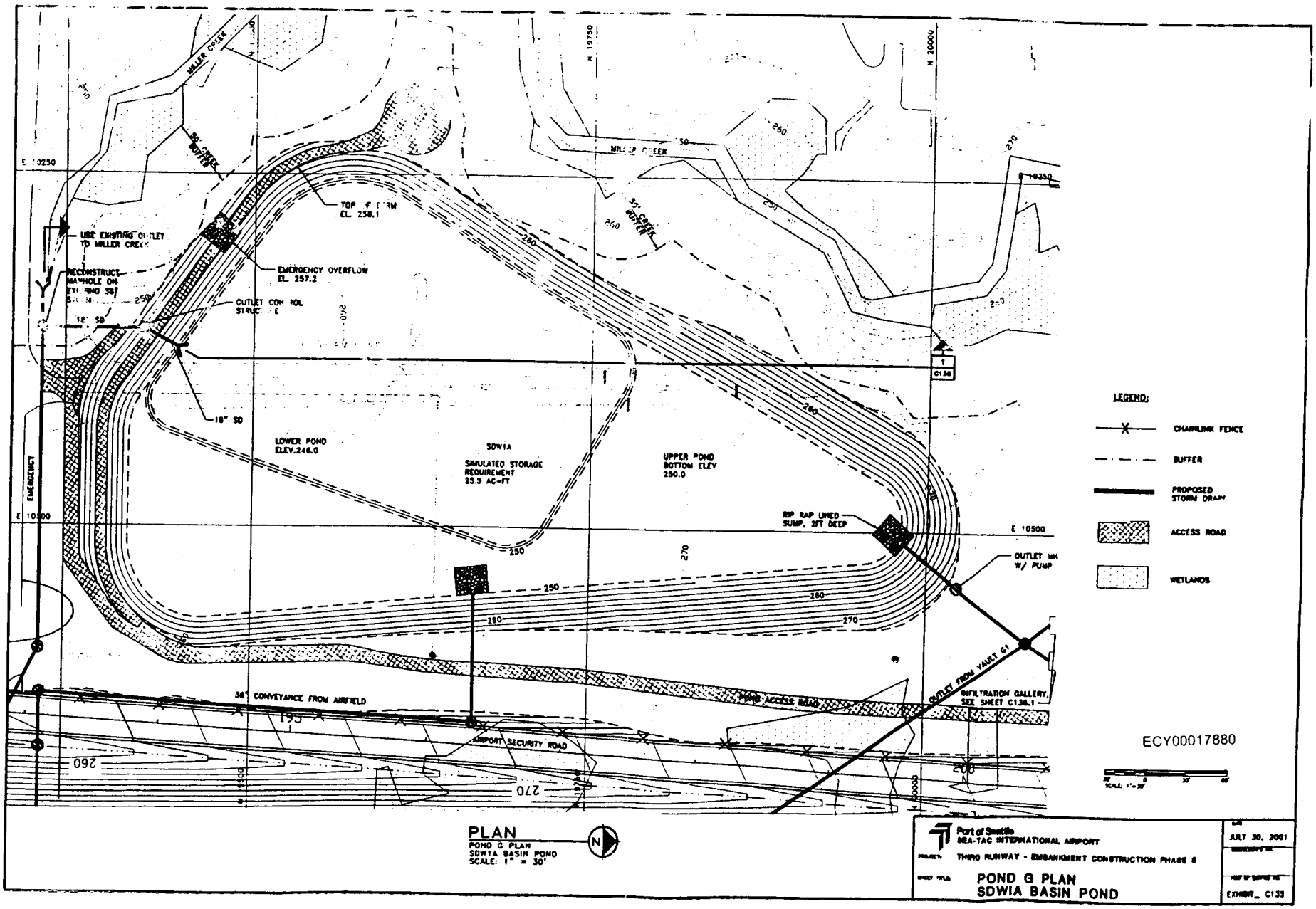


PROFILE
POND F PROFILE
SDW-2 BASIN POND
SCALE: HORZ 1" = 30'
VERT 1" = 6'
1
C131

ECY00017879

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 8
SHEET TITLE: POND F PROFILE
SDW2 BASIN POND
DATE: JULY 30, 2001
EXHIBIT_C132

AR 029233



AR 029234

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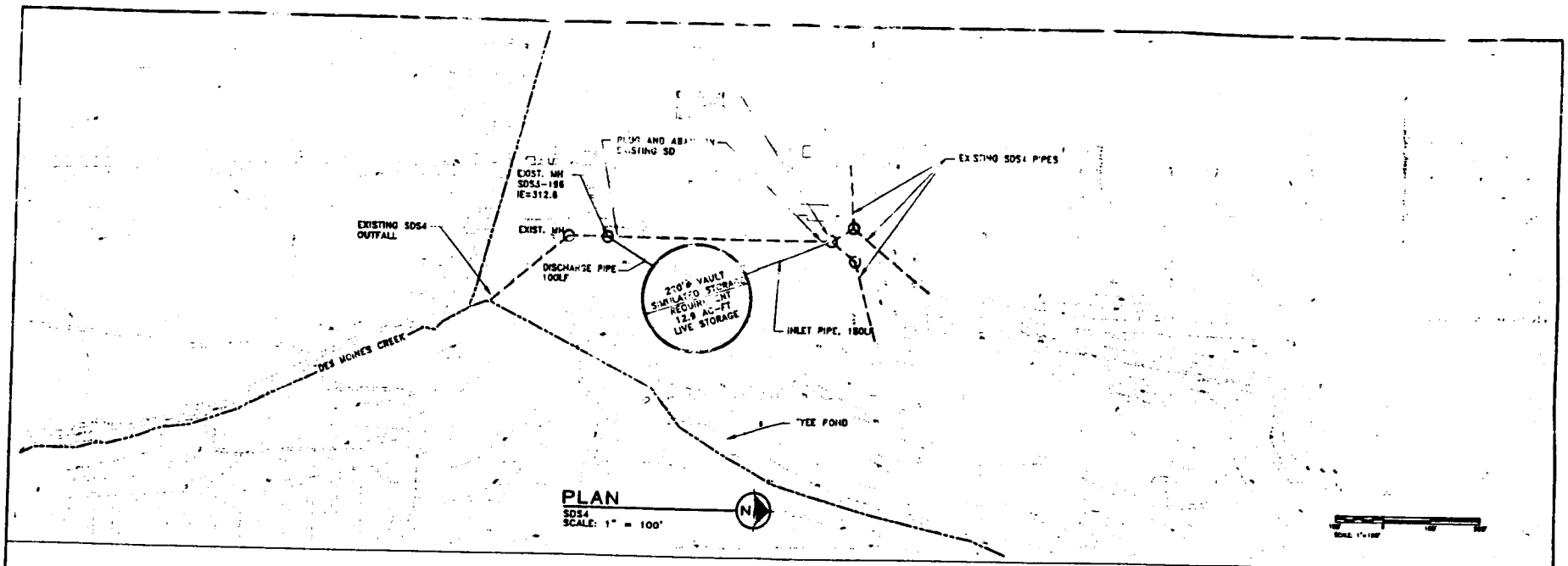
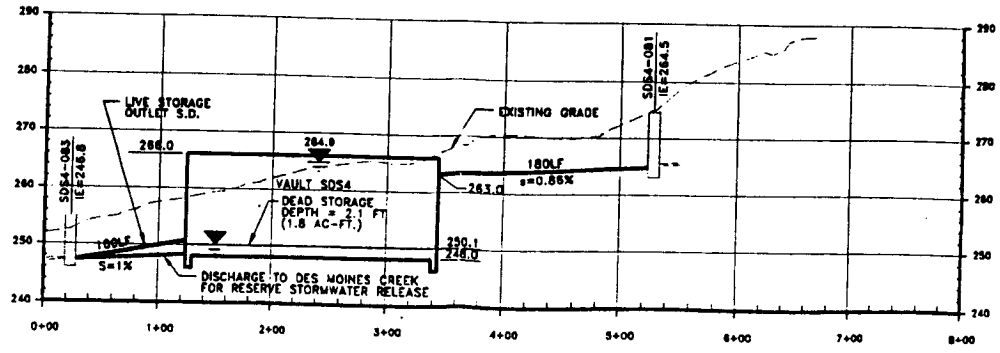




PROFILE
SDS4
SCALE: 1" = 50'

ECY00017881

July 2001
556-2912-001 (28)

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

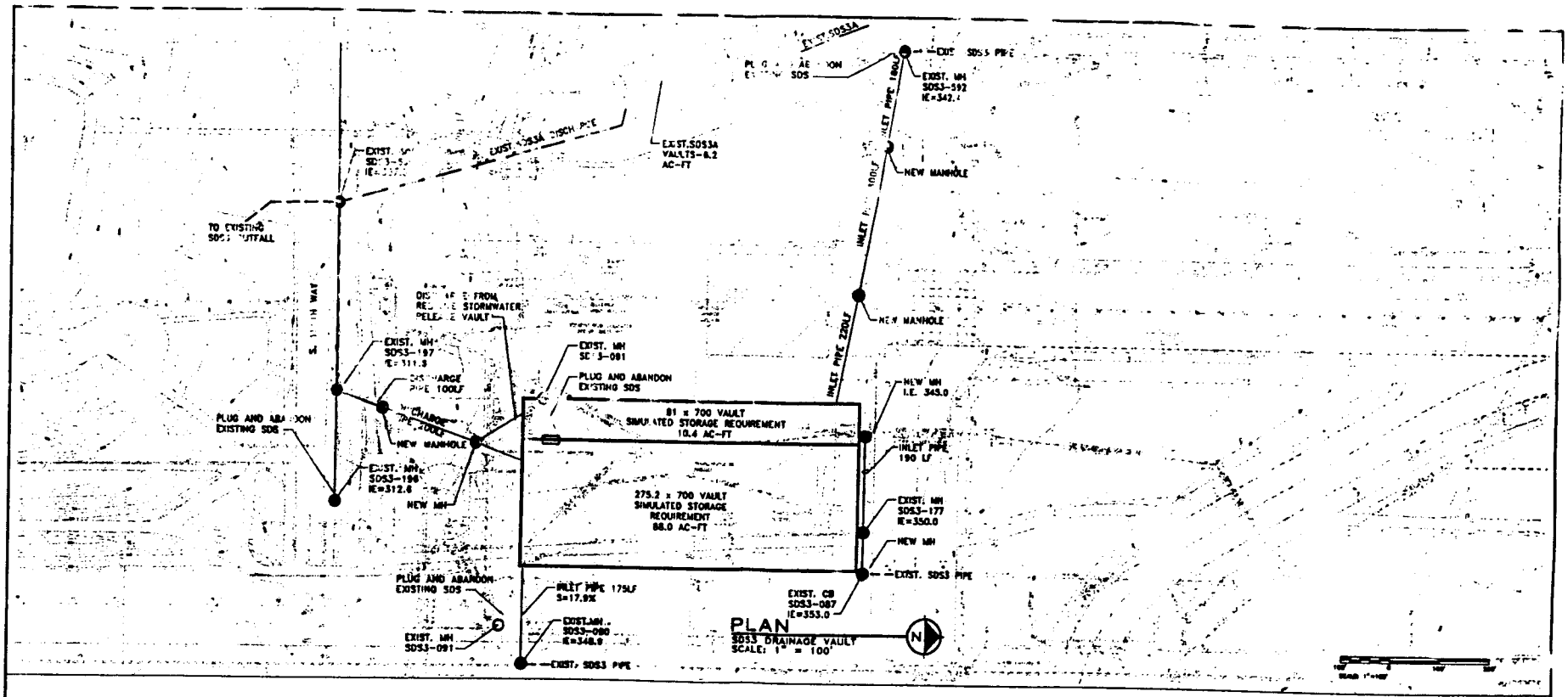
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 8

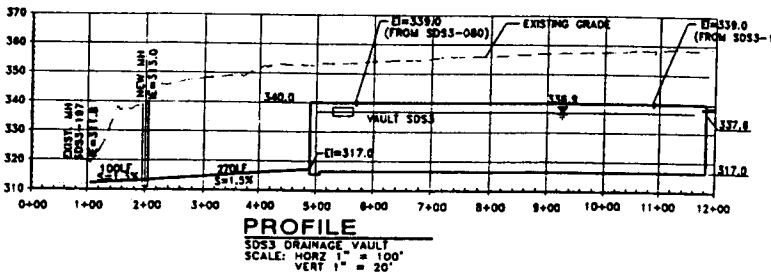
SHEET TITLE: **SDS4 BASIN VAULT PLAN AND PROFILE**

DATE: APRIL 18, 2001

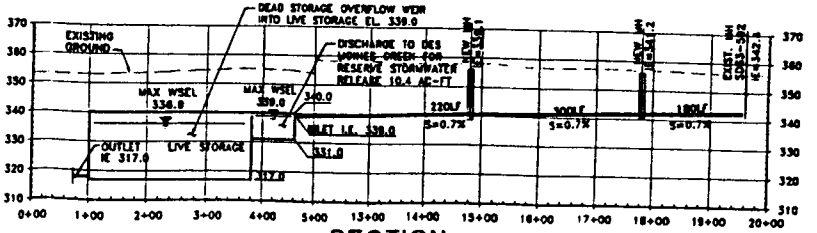
EXHIBIT_ C139

AR 029235





PROFILE
SDS3 DRAINAGE VAULT
SCALE: HORZ 1" = 100'
VERT 1" = 20'



SECTION
SDS3 DRAINAGE VAULT
SCALE: HORZ 1" = 100'
VERT 1" = 20'

ECY00017882

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

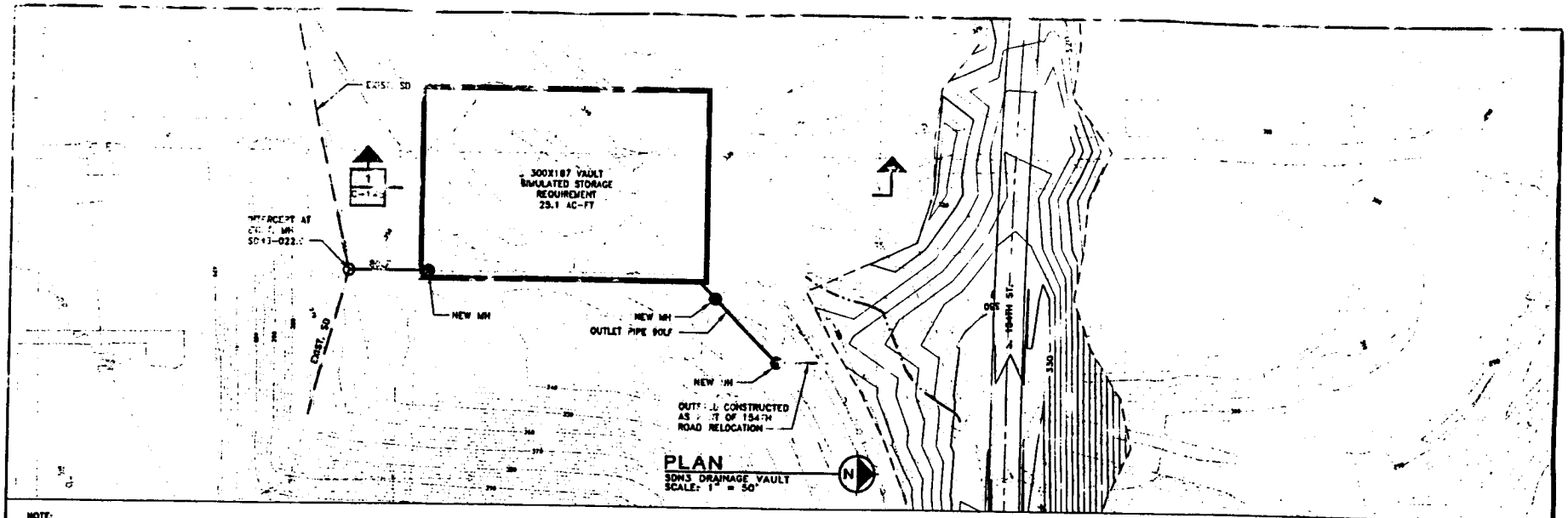
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

SHEET TITLE: SDS3, SDS3A AND SDS5 BASIN VAULT / PLAN AND PROFILE

DATE: JULY 30, 2001

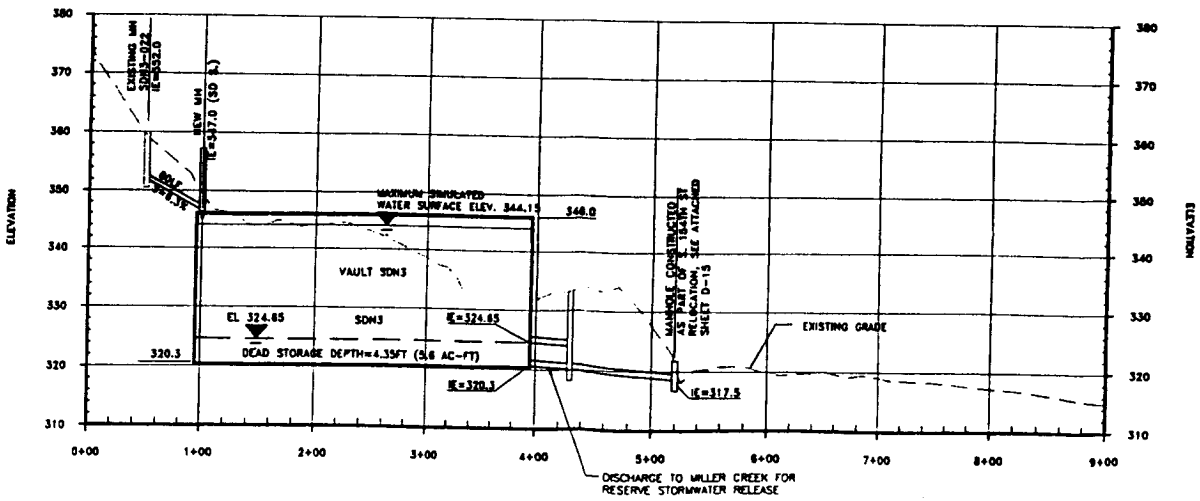
EXHIBIT_C141

AR 029236



NOTE:

THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.



ECY00017883

SECTION A

SDN3 DRAINAGE VAULT
SCALE: HORZ 1" = 50'
VERT 1" = 10'

1
C-145

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

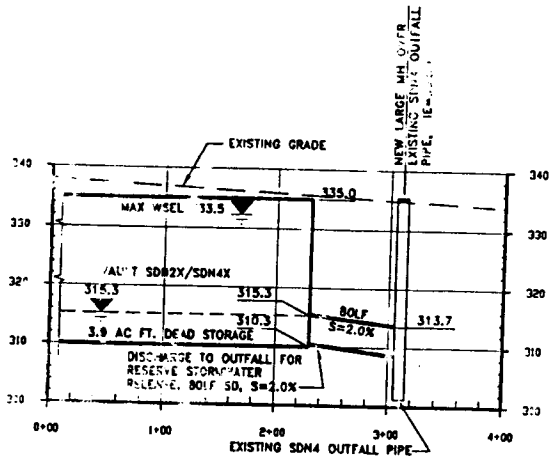
THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 8

SDN3 BASIN VAULT
PLAN AND PROFILE

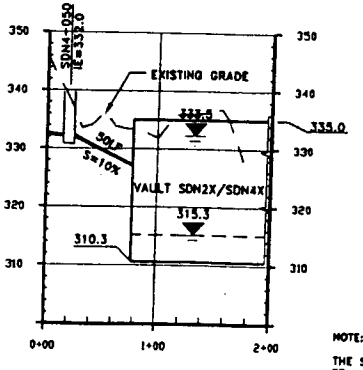
JULY 30, 2001

EXHIBIT_ C145

AR 029237



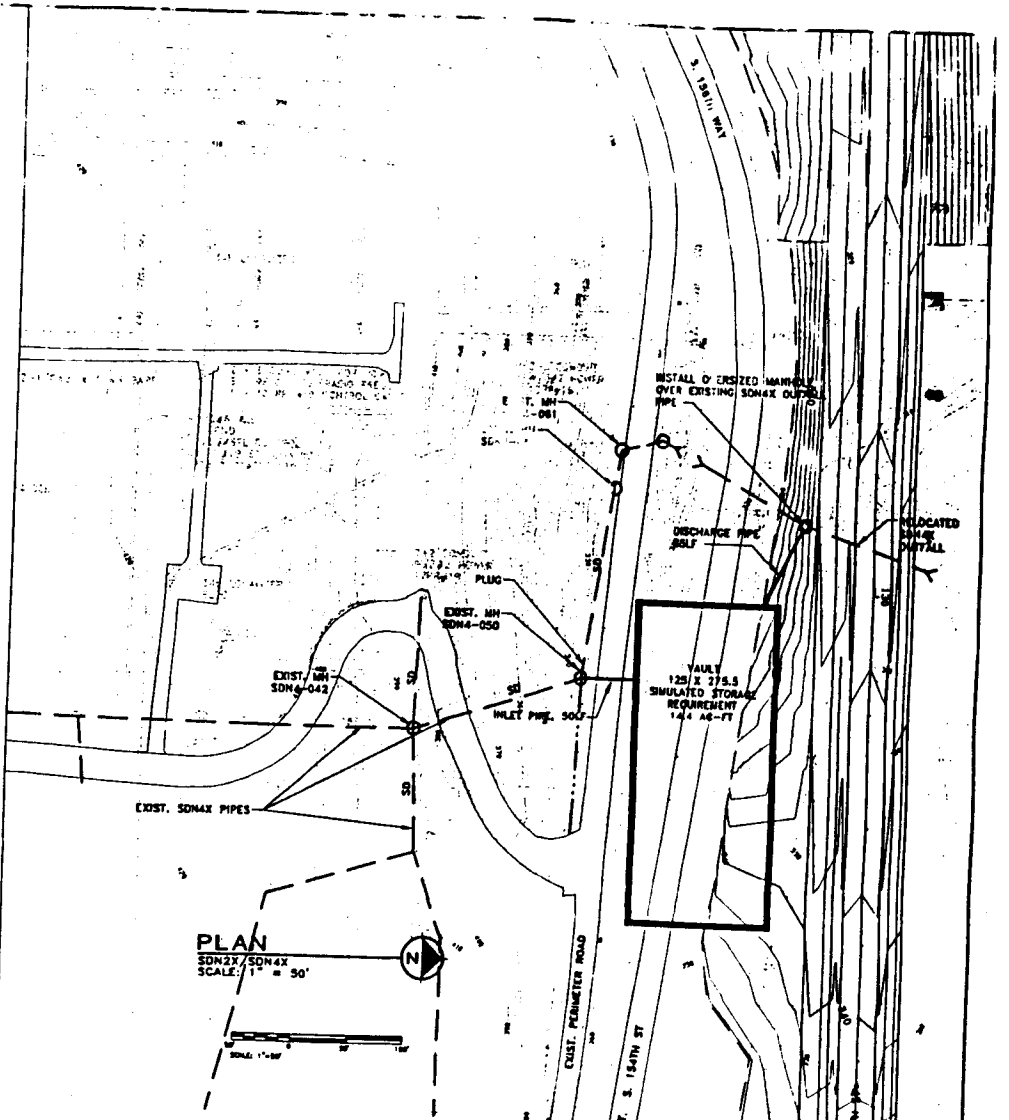
PROFILE
SDN2X/SDN4X
SCALE: HORZ 1" = 50'
VERT 1" = 10'



PROFILE
SDN2X/SDN4X
SCALE: HORZ 1" = 50'
VERT 1" = 10'

NOTE:

THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.

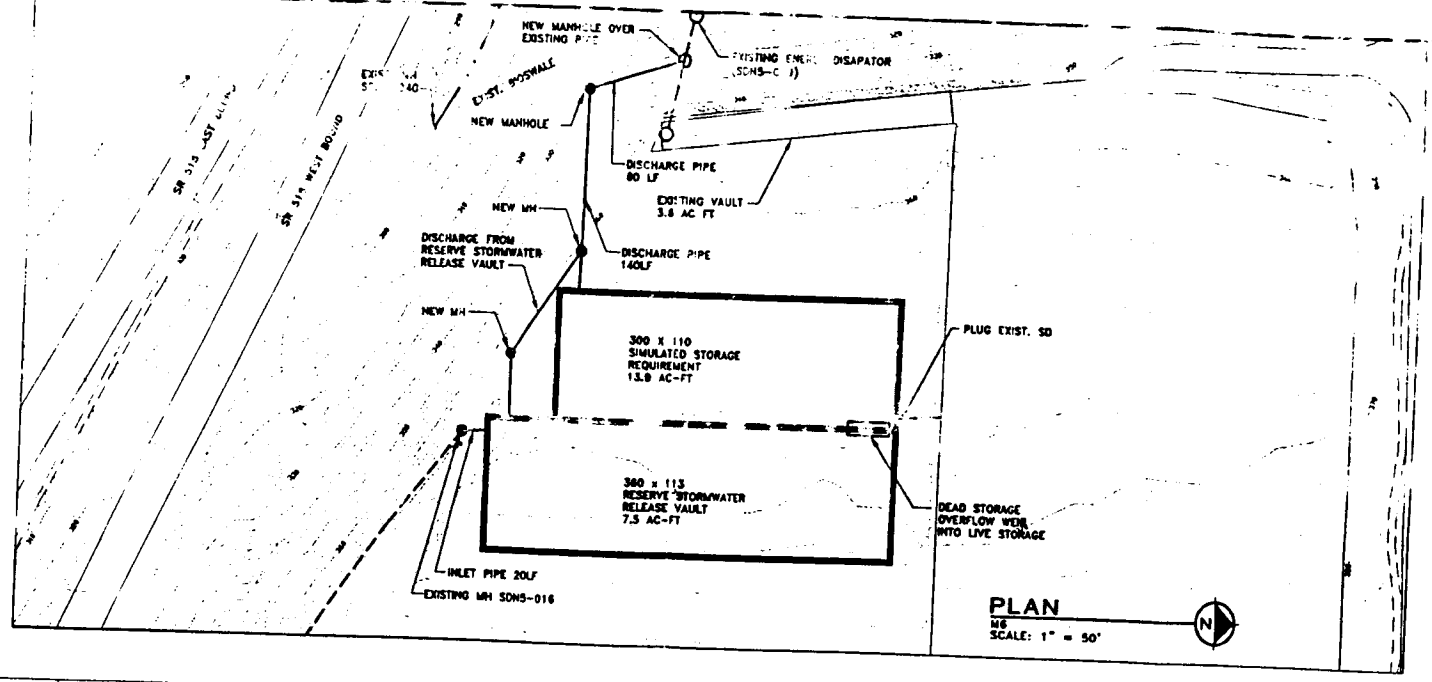


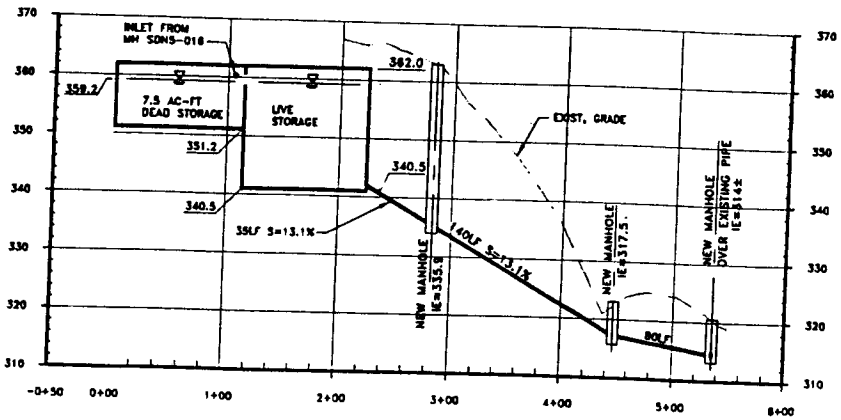
PLAN
SDN2X/SDN4X
SCALE: 1" = 50'

ECY00017884

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5
SDN2X/SDN4X BASIN VAULT PLAN AND PROFILE
JULY 30, 2001

AR 029238





PROFILE
M6
SCALE: HORZ 1" = 50'
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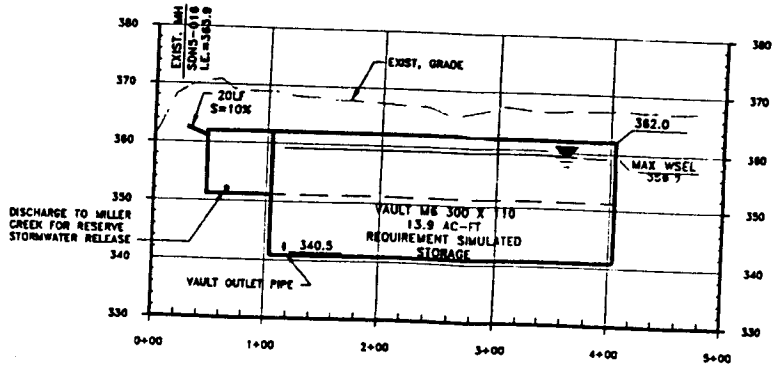


PROFILE
M6
SCALE: HORZ 1" = 50'
VERT 1" = 10'

NOTE:

THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.

ECY00017885

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

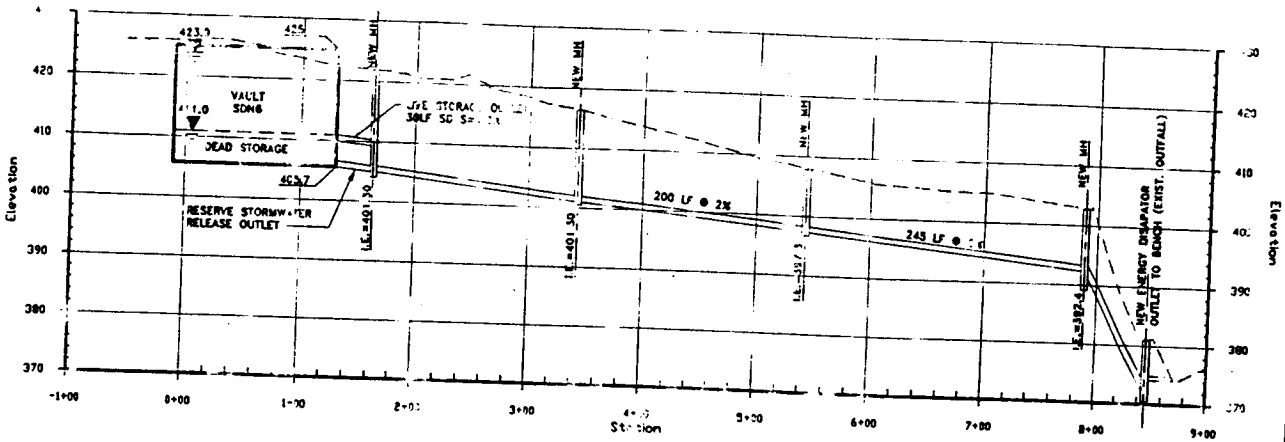
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

SHEET TITLE: M6 BASIN VAULT (NEPL) PLAN AND PROFILE

DATE: JULY 30, 2001

EXHIBIT C147

AR 029239



PROFILE
SDN6
SCALE: HORZ 1" = 50'
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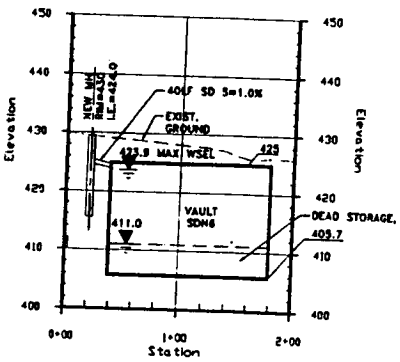

PROFILE
SDN6
SCALE: HORZ 1" = 50'
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NOTE:

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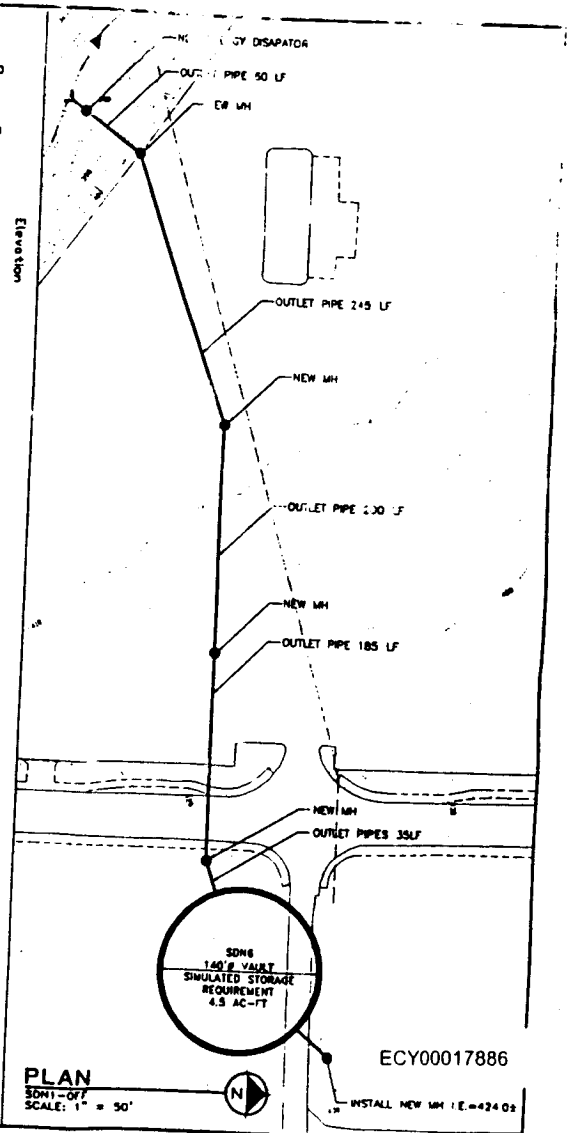


PLAN
SDN1-OFF
SCALE: 1" = 50'

ECY00017886

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

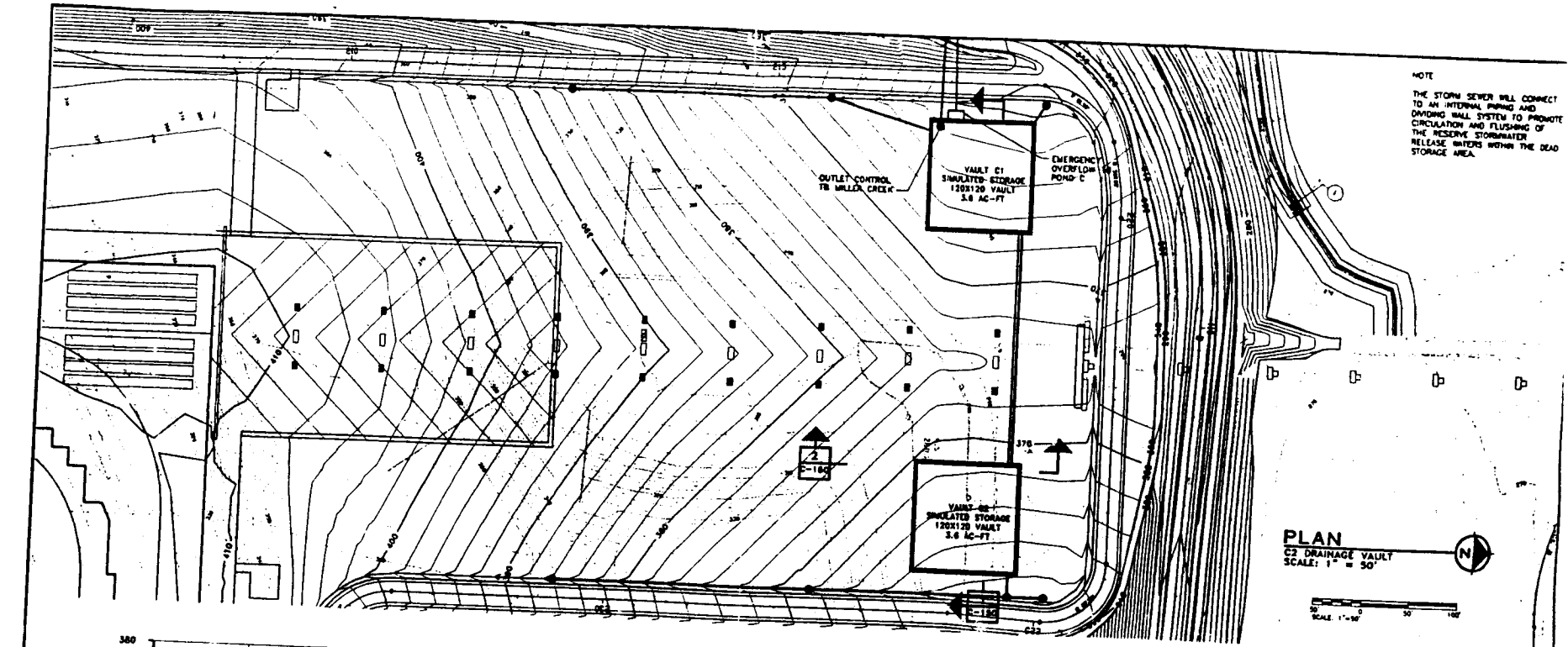
THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

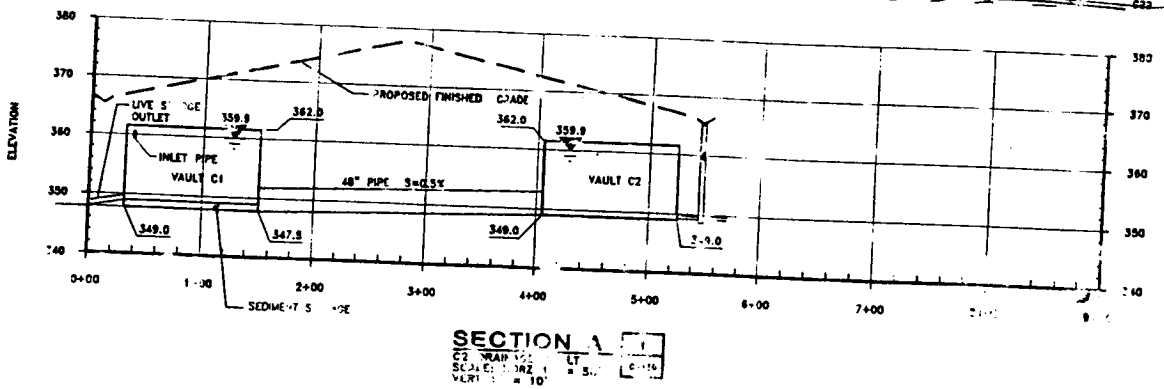
SDN6 (CARGO) BASIN VAULT
PLAN AND PROFILE

JULY 30, 2001

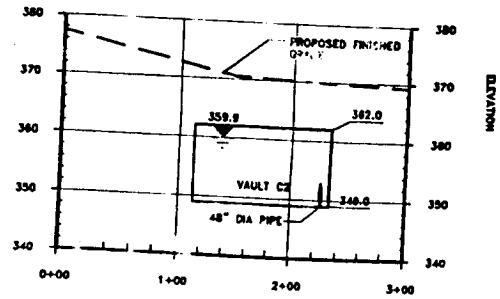
EXHIBIT_ C140

AR 029240





SECTION A
C2 DRAINAGE VAULT
SCALE: HORZ 1" = 50'
VERT 1" = 10'
2
C-156



SECTION B
C2 DRAINAGE VAULT
SCALE: HORZ 1" = 50'
VERT 1" = 10'
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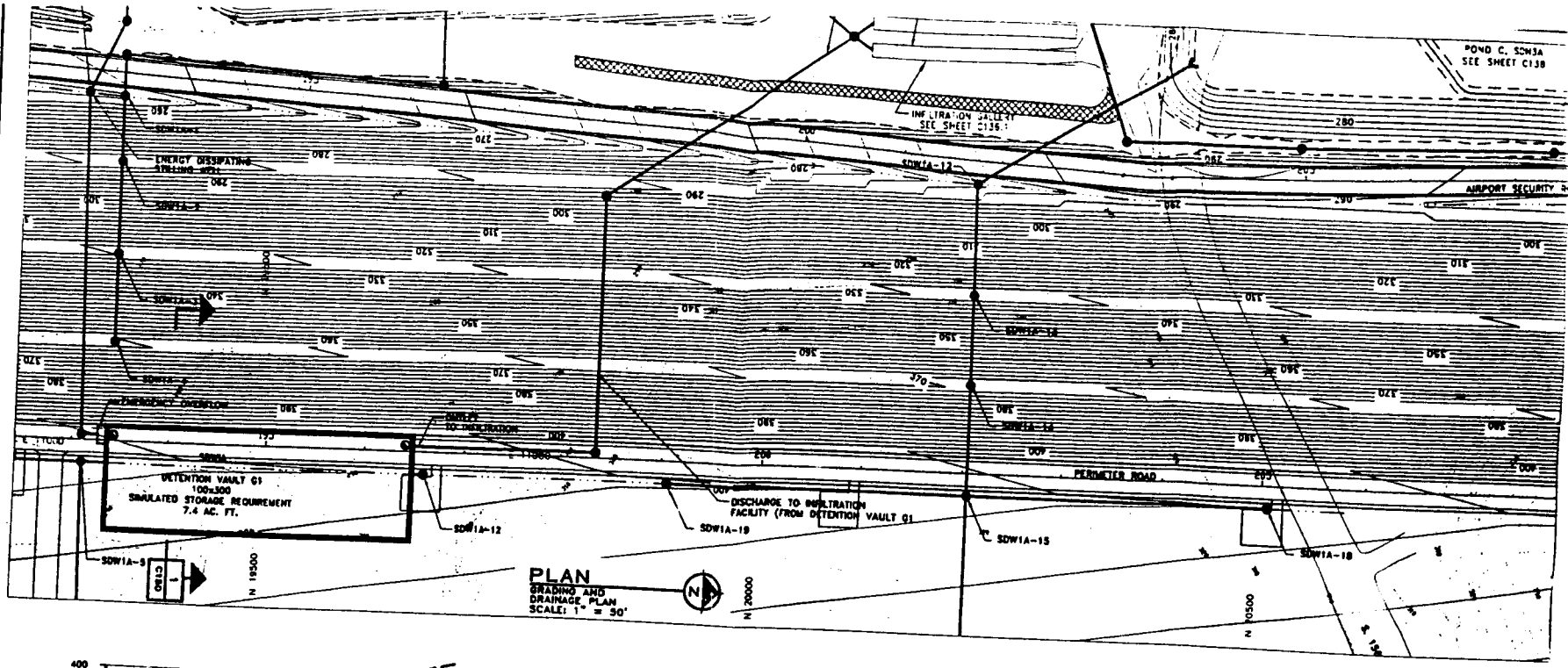
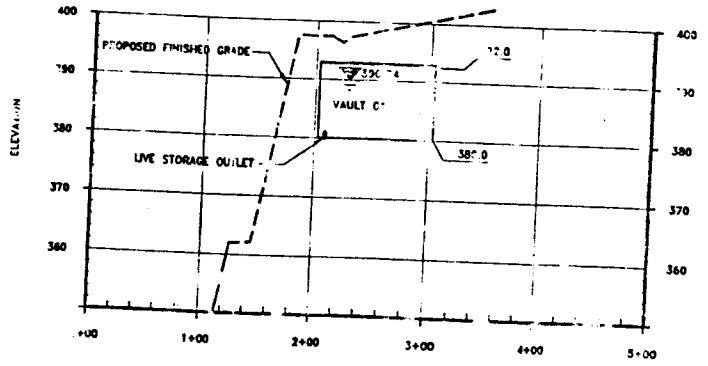
C-156

ECY00017887

PREPARED FOR: SEA-TAC INTERNATIONAL AIRPORT
PROJECT: THIRD RUNWAY DEVELOPMENT CONSTRUCTION PHASE B
SHEET TITLE: SDN3A BASIN VAULT C1/C2 PLAN AND PROFILE
JULY 30, 2001
EXHIBIT C-156

AR 029241





SECTION A

NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

KEY PLAN

SDW1A BASIN VAULT G1
PLAN AND SECTION

EXHIBIT 2151

AR 029242

ECY00017888

Parametrix, Inc. *Consultants in Engineering and Environmental Sciences*

5808 Lake Washington Blvd. NE, Suite 200, Kirkland, WA 98033-7350
425-822-8880 • Fax: 425-889-8808

TRANSMITTAL FORM

To: Ann Kenny
Department of Ecology
Northwest Regional Office
3190 160th Avenue S.E.
Bellevue, WA 98008-5452

Date: **July 31, 2001**
Project Number: **556-2912-001-01-03**
Project Name: **Port of Seattle**
Sea-Tac Airport MPU

We are transmitting the **3 copies** of the following materials:
Technical Memorandum, re: Stormwater detention ponds and wetland impacts.
Figures:

- Proposed Detention Facilities for Master Plan Projects
- Pond C Plan
- Pond D Plan
- Pond G Plan
- Pond F Plan

Drafts of Tables:

- 4.2-2 Non-native invasive species that will be monitored and controlled on the mitigation sites
- 4.2-1 Performance standards for vegetation cover (minimum percent) by vegetation zone and monitoring year.
- 5.1-7 Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm.
- 5.2-3 Final performance standards, evaluation approaches, and contingency measures for wetland and buffer enhancement along Miller Creek.
- 5.2-8 Final performance standards, evaluation approaches, and contingency measures for instream habitat enhancement along Miller Creek.
- 5.2-12 Final performance standards, evaluation approaches, and contingency measures for replacement drainage channels.
- 5.2-16 Final performance standards, evaluation approaches, and contingency measures for restoration of temporary wetland impacts.
- 5.3-6 Final performance standards, evaluation approaches, and contingency measures for monitoring borrow area wetlands.
- 5.3-2 Final performance standards, evaluation approaches, and contingency measures for the Tyee Valley Golf Course and Des Moines Creek buffer mitigation projects.
- 7.7-1 Final performance standards, evaluation approaches, and contingency measures for the Auburn wetland mitigation projects.

Comments:

AR 029243

These are:
- ☐ PER YOUR REQUEST
- ☐ FOR YOUR INFORMATION
- ☐ FOR YOUR REVIEW AND APPROVAL
- ☐ FOR YOUR FILES
- ☐ FOR YOUR ACTION

Sent Via:
- ☐ U.S. MAIL
- ☒ COURIER
- ☐ EXPRESS OVERNIGHT
- ☐ OTHER – INTEROFFICE
- ☐ HAND DELIVERY/PICK UP

Sincerely,

cc:

Sue Martin, Senior Technical Aide

AR 029244

Table 4.2-2. Non-native invasive species that will be monitored and controlled on the mitigation sites

Scientific Name	Common Name
Phalaris arundinacea	Reed canarygrass
Lythrum salicaria	Purple loosestrife
Polygonum cuspidatum	Japanese knotweed
Rubus discolor	Himalayan blackberry
Cytisus scoparius	Scotch Broom

Table 4.2-1. Performance standards for vegetation cover (minimum percent) by vegetation zone and monitoring year.

Monitoring Year	Vegetation Zone				Invasive Species
	Forest	Shrub	Emergent		
			Hydroseed	Planted	
0	-[a]	-	0	0	<10
1	-	-	50	10	<10
2	-	-	60	20	<10
3	10	10	70	30	<10
5	25	40	80	50	<10
7	40	65	80	70	<10
10	80	80	80	80	<10
12	80	80	80	80	<10
15	80	80	80	80	<10

[a] Vegetation cover will not be monitored in forest and shrub plant communities during monitoring year 0, 1, or 2. During these years, plant survival performance will be monitored. At year 1 survival must be 100% and at year 3, survival must average 80 percent of the original numbers planted.

Table 5.1-7. Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
1. Relocation of Miller Creek (relocated portion of stream (1080 ft) on Vacca Farm)			
1.[a] Construct low flow channel 8 feet wide with 1:1 slopes and 0.5 ft deep to convey summer base flows.	Maintain a minimum water depth of 0.25 ft (with flows of 0.5 cfs).	Dry and wet season measurements of water depths and velocities.	Evaluate factors responsible for not meeting performance standards. Adjust channel depth or channel bottom width using habitat features such as logs, boulders, root wads, etc., or regrading channel if necessary.
2.[a] Construct high flow channel 32 feet wide, with side slopes of 2:1 (typical) from depths of 0.5 to 1.0 ft to provide capacity for wet season base flow.	Wet season (October to April) average base flow depth is 1 ft (at 5 cfs).	See above.	See above.
3. The channel cross section will provide an average dry season base flow velocity that is greater than the silt transport velocity (0.7 ft/sec).	Average flow velocities will exceed 0.7 ft/sec at flows of 0.5 cfs or greater.	Measurements of stream velocity.	Alter velocities in low-flow channel using woody debris or boulders. Narrow portions of channel using LWD, boulders, or gravel bars to increase velocity.
4. Design a natural channel with stable gravel bottom in riffle sections suitable for spawning of cutthroat trout.	Substrates will contain less than 20% fine sediments (i.e., sand or smaller) in riffle sections.	Riffle areas will be delineated as part of the as built plans. A volumetric assessment of substrate (using McNeil cores or bulk samples) will be performed to document substrate conditions.	If fine sediments are present, evaluate sources; if sources are on Port property, implement stabilization measures to control or eliminate fine sediments. Alter velocities in low-flow channel using woody debris or boulders to adjust channel width.
5. Channel flow velocity is less than the gravel movement velocity (4 ft/sec) at the 100-year flow (175 cfs)..	Scoured channel bottom sections, if present, shall not cumulatively exceed 10 linear feet. Bed material size will not increase significantly compared to as-built conditions.	A volumetric assessment of substrate (using McNeil cores or bulk samples) will be used to document substrate conditions. Channel surveys will be performed to evaluate the presence of scouring or erosion.	Adjust width of channel, replace spawning gravels, and/or repair any eroded channel banks with bioengineering or additional streambank plantings.

Table 5.1-7. Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm (continued).

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
6. Flows greater than the annual peak flow will overtop the channel and inundate the adjacent floodplain restoration.	Flows greater than the annual peak (40 cfs) will overtop the stream banks and flow into the floodplain.	Measure water elevations in the stream channel and floodplain and relate to stream flow and as built topography (e.g., floodplain elevation and berm height).	Adjust bank height, channel morphology, or roughness to alter amounts of over bank flow. Regrade channel banks if necessary.
7. Provide instream habitat features such as deflectors and overhanging logs as needed to maximize available habitat.	A minimum of 20 in-stream habitat features (e.g., LWD, overhanging logs, deflector logs, or root wads) will be present.	Measure abundance, sizes, and location of LWD in the new channel.	If losses of LWD occur, evaluate factors contributing to reduction in LWD (e.g., high flows) and address. Add LWD to channel as necessary.
8. Provide approximately 3.0 acres of vegetated buffer on the east side of the channel. Establish native vegetation along channel banks and the riparian zone of the new channel.	Establish 3.0 acres of native shrub/forested riparian zone and upland buffers with an average tree density of at least 280 stems/acre and shrub density of at least 2,100 individuals per acre. At Year 1, survival of planted stock will be 100%. Average survival of planted trees and shrubs in the first 3 monitoring years shall be at least 80%; cover of native species will be 80% by year 15[b]. Cover of non-native invasive[c] species will be no greater than 10% by monitoring year 15.	Vegetation sampling (plots, transects, or plotless techniques) to measure stem density plant cover, count live and dead plants, and measure cover of non-native invasive species.	Install additional plants if necessary. Identify substitute native species that are adapted to site conditions Eliminate or reduce the abundance of non-native invasive species. Install protective collars to reduce herbivore damage.
9. Densely plant woody vegetation along the new channel to cover open water and reduce use of the area by waterfowl.	Canopy cover extending over the low flow channel will be 80 percent by the end of the monitoring period[d].	Vegetation sampling to determine tree and shrub cover over the portion of the channel below the ordinary high water mark (OHWM).	Add additional plants if areas of exposed stream channel are present.

Table 5.1-7. **Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm (continued).**

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
II. Wetland Enhancement and Restoration on Vacca Farm			
1.[a] Provide for approximately 5.94 acre-ft of flood storage on Vacca Farm to compensate for approximately 5.24 acre-ft filled for the embankment. Excavate drainage swales to provide positive drainage from the floodplain and prevent standing water during non-flood periods.	Provide 5.9 acre-ft of flood storage to compensate for 5.2 acre-ft filled for the embankment.	Record drawings and hydrologic monitoring to verify necessary flood storage is present	Regrade area if not excavated to specifications. Modify design of swales to improve drainage conditions if necessary.
2. Use excavated material from grading the floodplain to create topographic variation in the floodplain.	Topographic features (mounds, ridges)[e] will be constructed at a density of 4 per acre. Dimensions of these features will range between 4 and 8 feet wide; 8 and 16 feet long, and 1 and 2 feet high.	Determine density from record survey.	Construct additional features if project has not been built to specifications.
3. Remove ditches and drains to reduce drainage rates and improve wetland hydrology. Grade floodplain to elevations that restore wetland hydrology.	Groundwater levels in the floodplain wetlands will be within 10 inches of the soil surface for at least the period between March and June during years of normal[f] precipitation.	Hydrologic monitoring using shallow wells. Evaluate hydrologic conditions relative to recent precipitation.	Modify grading, drainage swales, or channel configuration to decrease or promote soil saturation.

Table 5.1-7. Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm (continued).

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
4. Restore and enhance wetland and upland habitats on Vacca Farm: Enhance and restore farmed wetlands, existing wetlands, and prior converted cropland in the floodplain and wetlands around Lora Lake with native vegetation (see Table 5.1.1). Enhance existing floodplain and Lora Lake shoreline buffer with native vegetation (see Table 5.1.1).	The restoration area, including wetland restoration, wetland enhancement, and buffers will be a minimum of 11 acres as shown in Table 5.1-1.	Determine area from record survey.	Modify construction if not built as specified.
5. Plant native trees, shrubs and herbaceous (see Table 5.1-11, Table 5.1-12) species in these areas at tree densities of greater than 280 trees per acre (trees include willow species) and shrub densities of greater than 2,100 per acre. Intersperse scattered native conifers in this area.	At year 1, survival of planted stock will be 100%. Shrub and tree survival will average at least 80% in the first 3 monitoring years. At year 3, at least 280 trees per acre (including willow species) and 2,100 shrubs/acre will remain. Percent cover of native species will be at least 80% by year 15[b]. Non-native invasive[c] species cover will be no more than 10% by year 15 in newly planted areas. By the end of year 3, the number of species of trees and shrubs will not decrease by more than 10% from the number installed at baseline.	Vegetation sampling (plots, transects, or plotless techniques) measure vegetation cover and diversity.	If standards are not met: • Select species that are better adapted to existing hydrologic conditions. • Install additional plant material. • Install protective collars to reduce herbivore damage. • Control/reduce non-native invasive species.
	Percent cover of native herbaceous species will be at least 80% by year 15[b].	Vegetation sampling (plots, transects, or plotless techniques) to estimate canopy cover.	See above.

Table 5.1-7. Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm (continued).

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
6. Enhance existing forested wetland south of Lora Lake with native shrubs to provide a diverse understory. Total density of native shrubs will be at least 1,700 individuals per acre.	At Year 1, survival of planted stock will be 100%. Average survival of planted stock will be at least 80% in the first 3 monitoring years. Following year 3, shrub density will be at least 1,700 shrubs per acre. Percent cover of non-native invasive[c] species in the understory will be no more than 20% by monitoring year 15 in areas where existing wetland is being enhanced. By the end of year 3, the number of species of shrubs will not decrease by more than 10% from the number installed at baseline.	Vegetation sampling (plots, transects, or plotless techniques) to estimate canopy cover.	See above.
III. Lora Lake Buffer Enhancement			
1. Plant a 25-ft buffer (0.60 acre) around Lora Lake with native trees and shrubs. Plant native tree species at densities of greater than 280 per acre (total of at least 168 trees). Plant native shrub species at densities of greater than 2,100 (total of at least 1,260) per acre.	At Year 1 survival of planted stock will be 100%. Average survival of planted stock will be at least 80% in the first 3 monitoring years. Following year 3, at least 168 trees and 1,260 shrubs will be present in the buffer. Percent cover of native species will be at least 80% by year 15[b]. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline. Non-native invasive[c] species cover will be no more than 10% by year 15 in newly planted areas.	Vegetation sampling (plots, transects, or plotless techniques), as described above.	Contingency measures for vegetation performance standards are described above.
2. Concrete bulkhead will be removed and shoreline graded to a stable slope configuration.	Record drawings and photo documentation verify that the concrete bulkhead has been removed.	Record drawings to verify removal and bulkheads and slope of shoreline.	Remove all structures and bulkhead areas to be consistent with design.

Table 5.1-7. Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Vacca Farm (continued).

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
	New shoreline of Lora Lake will have a slope of 3:1 or gentler.		Re-grade as necessary to be consistent with design.

a Compliance with this performance standard will be determined from the as-built drawing, and will generally not require ongoing monitoring.

b See Table 4.2-1 for interim cover targets (i.e., from year 3 to year 15).

c See Table 4.2-2 for list of invasive, non-native species to be monitored and controlled on the mitigation site.

d During the first few growing seasons following establishment of the new channel, shade will be provided over the channel with the use of nursery shade cloth to shade out about 75% of the ambient solar radiation.

e See Appendix A for design details.

f Years of normal rainfall will be based on the definition for 'most years' given in the USACE 1987 Manual; annual precipitation in a normal year must be the same as or greater than precipitation in 5 years out of 10, OR normal rainfall will be average annual rainfall +/- one standard deviation of the mean.

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Table 5.2-3. **Final performance standards, evaluation approach, and contingency measures for wetland and buffer enhancement along Miller Creek.**

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
1. Riparian buffer areas that are cleared or disturbed during demolition will be planted with native forested and shrub vegetation (these are shaded in Appendix B, Sheets L1 through L5.1). Plant native tree species at densities of greater than 280 per acre. Plant native shrub species at densities of greater than 2,100 per acre.	Plant survival will be 100% following year 1. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Following year 3, tree density will be at least 280 stems/acre; shrub density will be at least 2,100 individuals per acre. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline. Cover of native species will be at least 80% at monitoring year 15[a]. Cover of non-native, invasive[b] species in cleared and planted areas will not be more than 10% at monitoring year 15 (see Appendix B, Sheets L1 through L5.1 for locations where this standard will apply).	Vegetation sampling (plots, transects, or plotless techniques) to estimate native species cover, density, and mortality, and invasive species cover.	If standards are not met: • Select species that are better adapted to existing hydrologic conditions. • Install additional plant material. • Install protective collars to reduce herbivore damage. • Control/reduce non-native invasive species.
2. Lawn and other areas dominated by non-native plant species, will be enhanced by planting native forested vegetation.	Plant survival will be 100% following year 1. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Following year 3, tree density will be at least 280 stems/acre; shrub density will be at least 2,100 individuals per acre. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline. Cover of native species will be at least 80% at monitoring year 15[a].	See above.	See above.

Table 5.2-3. **Final performance standards, evaluation approach, and contingency measures for wetland and buffer enhancement along Miller Creek (continued).**

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
3. Densely plant the portion of the buffer adjacent to Miller Creek with native trees and shrubs where applicable to provide future sources of LWD to the stream.	Density of trees in buffer is at least 280 stems/acre.	See above.	See above.
5. Install fencing and signs to designate the buffer area as protected mitigation site.	Signs and fencing clearly mark the buffer edge as a protected mitigation site.	Check signs and fencing during annual monitoring visits	Repair and/or re-install damaged or missing signs.

a See Table 4.2-1 for interim cover targets (i.e., from year 3 to year 15).

b See Table 4.2-2 for list of invasive, non-native species to be monitored and controlled on the mitigation site.

Table 5.2-8. Final performance standards, evaluation approach, and contingency measures for instream habitat enhancements in Miller Creek.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
1. Remove cemented riprap along banks, encourage natural formation of meander bends and cut benches.	Channel armoring, walls, and riprap are removed from the channel in each project reach per design specifications. Channel reach in project area is free of man-made debris.	Inspection to verify removal of riprap and other in-channel structures consistent with design. Baseline monitoring to establish as-built number and type of habitat features (pools and riffles).	Remove riprap or other structure consistent with design. Add LWD to create additional channel complexity and promote formation of pools and riffles.
2. Increase the amount of LWD in the channel.	Number of LWD features in stream remains stable or increases compared to baseline (as-built) conditions.	Record survey and visual inspection of channel	Add LWD to create additional channel complexity.
	Number and density of habitat features (e.g., pools, riffles, bars, and undercut banks) remain stable or increase compared to baseline (as-built) conditions.	Record survey and visual inspections. Measure density and number of habitat features	Add LWD to create additional channel complexity and promote formation of pools and riffles.
3. Stabilize areas of erosion by using native vegetation and LWD.	Cover of stream bank vegetation in enhancement will be at least 50% on channel banks. Bank stabilizing LWD, as shown on record drawings, remains in place.	Site inspections and record drawings.	Repair damaged bank if necessary. Stabilize banks with additional LWD, live stakes, or seeding.
4. Remove all trash from the channel that could be harmful to fish habitat, and water quality.	Channel reaches in project area are free of debris (e.g., tires, metal debris, wire, pipe, etc.).	Site inspections.	Clear any remaining trash in the buffer.
5. Add gravel to degraded reaches where natural recruitment is limited.	Substrate is predominantly gravel (>50 percent) on bars and benches.	Assess substrate composition with pebble counts. Visual inspection	Evaluate source of sediment and remove/control. Add channel features (e.g., large wood, and boulders) to reduce bedload movement.

Table 5.2-12. Final performance standards, evaluation approach, and contingency measures for replacement drainage channels.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
1[a]. Construct the replacement channel to convey the 100-year, 24-hour design storm, and seepage water collected by the embankment drain layer and adjacent areas.	Channel depths will be a minimum of 2 ft deep with side slopes of 3:1 or gentler with log and rock weirs to protect channel banks.	Verify with record drawings.	Enlarge channel if conveyance inadequate.
2. Direct water in drainage channels to discharge points in or adjacent to riparian wetlands along Miller Creek (Wetlands A13, 18, 37a, 39, 44a, R9).	Flowing water will be present in Segment B and Segment C from December to June in years of normal[b] rainfall. Groundwater in wetlands with predominantly organic soils (Portions of Wetland 18, 37a, R14a, A14b, and 44a) will be within 10 inches of the soil surface at least between March and mid-June in years of normal[b] rainfall. Other wetlands with predominantly mineral soils will have soils saturated in the upper part to mid-April in years of normal[b] rainfall. Wetland indicator status (WIS) of the dominant plant species will not differ from pre-project conditions during the monitoring period; WIS at the end of the monitoring period will not differ from pre-project conditions. WIS status of the vegetation will be calculated as in the 1989 USACE wetland delineation manual.	Measurements of channel baseflow by installing weirs that allow quantity of water flowing through channels to be determined. Map organic and inorganic soils; characterize wetland vegetation. Monitor duration and depth to water table in wetlands to determine if wetland hydrology persists. The data will be related to pre-project conditions[c] – i.e., the wetland indicator status of dominant wetland plants, the information on vegetation tolerance of various hydrologic regimes, and the intensity of reducing soil conditions (i.e. iron reduction (creating mottled and gleyed soil colors) or organic matter accumulation). This analysis will be used to determine whether the post-construction hydrology observed	Modify discharge points from channel to wetlands to meet performance standards. Divert treated stormwater from up slope stormwater ponds to drainage channels. Improve drainage paths to convey water to wetlands. Remove obstructions and/or enlarge channels as needed. Reconfigure drainage channels to maintain flows (i.e., longer drainage channels to collect more water for distribution to wetlands). If wetlands are found to be drier than under pre-project conditions: Divert treated stormwater from up slope stormwater ponds to drainage channels (the source of this stormwater could be from biofiltration swales, filter strips, etc. treating runoff from the perimeter road). Reconfigure discharge (i.e., location, size and number of discharge points that distribute water to wetlands from drainage channels). If these wetlands are wetter than under pre-project conditions: A portion of the water in the drainage

Table 5.2-12. Final performance standards, evaluation approach, and contingency measures for replacement drainage channels (continued).

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
		through monitoring can reasonably be expected to maintain the wetland soils and vegetation currently present in the wetlands.	channels will be directed to Water W rather than into the wetlands
3. Plant native shrubs at greater than 2,100 individuals per acre and native trees at greater than 280 trees per acre along channel banks.	Shrub density will be at least 2,100 individuals per acre. Tree density will be at least 280 stems per acre. At Year 1, survival of planted stock will be 100%. Average tree and shrub survival will be at least 80% during the first 3 monitoring years. Average canopy cover of native species will be at least 80% by monitoring year 15.[d] By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline. Cover of non-native invasive[e] species will be no more than 10% by monitoring year 15.	Vegetation sampling (plots, transects, or plotless techniques) to estimate cover, density, mortality, and invasive species.	If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material. Install protective collars to reduce herbivore damage Control/reduce non-native invasive species.

a Indicates a key design standard to be determined from the as-built condition. These standards typically do not require ongoing monitoring.

b Years of normal rainfall will be based on the definition for 'most years' given in the USACE 1987 Manual; annual precipitation in a normal year must be the same as or greater than precipitation in 5 years out of 10; OR normal rainfall will be the average annual precipitation +/- 1 standard deviation of the mean.

c Pre-project vegetation and soil conditions are documented in the Wetland Delineation Report (Parametrix 2000).

d See Table 4.2-1 for interim cover targets (i.e., from year 3 to year 15).

e See Table 4.2-2 for a list of invasive, non-native species to be monitored and controlled on the mitigation site.

Table 5.2-16. Final performance standards, evaluation measures, and contingency measures for restoration of temporary wetland impacts.

Design Criteria	Performance Standard	Evaluation Methods	Contingency Measures
1. Grade areas to pre-construction elevations if pre-construction grades have been modified.	Pre-disturbance wetland topography is restored.	Comparison of pre- and post-construction topography.	Regrade if necessary.
2. Grade to reestablish pre-construction hydrology.	Wetland areas will meet wetland criteria (hydrophytic vegetation, hydric soils, hydrology) following restoration (see Table 5.2.12).	Monitor the depth to and the duration of soil saturation (See Table 5.2.12).	Regrade if necessary. Use water collected by drainage channels to supplement wetland hydrology.
3. Restore impacted areas with native forest vegetation. Emergent wetland communities will be replanted with forest vegetation to increase wetland functions and reduce potential use by waterfowl.	In revegetated areas, survival will be 100% at the end of year 1; average survival of planted stock will be at least 80% during the first 3 monitoring years. Cover of native species will be at least 80% by the end of the 15-year monitoring period[a]. Cover of non-native invasive[b] species will be no more than 10% at the end of the 15-year monitoring period. Re-vegetated wetlands will have a tree density of at least 280 per acre and a shrub density of at least 2,100 individuals per acre. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	Vegetation sampling (plots, transects, or plotless techniques) to estimate mortality, cover, density, and presence of invasive species.	If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material Install protective collars to reduce herbivore damage. Control/reduce non-native invasive species.
4. Disturbed ground within 50 ft of the wetlands will be hydroseeded or otherwise stabilized to prevent erosion impacts to the wetland.	Vegetation cover within 50 ft of wetlands will exceed 80 percent within 1 year following restoration.	Measure plant cover using vegetation monitoring techniques.	Install erosion control fabric. Install additional hydroseed or plants in upland areas.

a See Table 4.2-1 for interim cover targets (i.e., from year 3 to year 15).

b See Table 4.2-2 for list of invasive, non-native species to be monitored and controlled on the mitigation site.

Table 5.3-6. Final Performance Standards, Evaluation Approach, and Contingency Measures for Monitoring Borrow Area Wetlands.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
Maintain wetland hydrology by redirecting surface water runoff to the wetlands near Borrow Area 1.	Soils in wetlands near Borrow Area 1 (Wetlands 48 and B15) will be saturated to the surface from December to April in years of normal[a] rainfall.	Shallow groundwater monitoring wells.	Minor regrading to direct surface water runoff to wetlands
Maintain wetland hydrology by directing groundwater seepage and surface water runoff via an interceptor swale to wetlands in and near Borrow Area 3.	Wetland 30 will have shallow standing water up to 24 inches deep during the breeding season for resident amphibians (i.e., December through April).	Shallow groundwater monitoring wells.	Adjust length and discharge points of interceptor swale system
	Wetland 29 will have soils saturated to the surface from December through April in years of normal[a] rainfall.	Shallow groundwater monitoring wells.	Adjust length and discharge points of interceptor swale system

a Years of normal rainfall will be based on the definition for 'most years' given in the USACE 1987 Manual; annual precipitation in a normal year must be the same as or greater than precipitation in 5 years out of 10; OR normal rainfall will be the average annual precipitation +/- 1 standard deviation of the mean.

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Table 5.3-2. Final Performance Standards, Evaluation Approach, and Contingency Measures the Tyee Valley Golf Course and Des Moines Creek Buffer Mitigation Projects.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
1. Plant 5.5 acres of the golf course wetland with native wetland shrub species; mitigation area includes wetland area on left and right branch Des Moines Creek.	Shrub wetland vegetation will be planted on 5.5 acres of golf course. Upland shrub vegetation will provide a buffer and cover about 1.57 acres.	Verify area requirements with record drawings	Plant additional areas if as-built conditions are not consistent with design
	Soils will be saturated within 10 inches of the surface (for at least 2 weeks during the growing season) in years of normal[a] rainfall.	Monitor depth and duration of soil saturation	Wetland hydrology currently exists on this site, and no changes are likely. Modify surface drainage features
2. Shrub and small trees planted at combined density of greater than 3,375 stems per acre	Survival of planted stock will be 100% at the end of year 1. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Cover of native species will be at least 80% by monitoring year 15[b]. Cover of non-native invasive species will be no more than 10% by monitoring year 15[c].	Vegetation sampling (plots, transects, or plotless techniques) to estimate mortality, cover, density, and presence of invasive species.	If standards are not met: • Select species that are better adapted to existing hydrologic conditions. • Install additional plant material. • Install protective collars to reduce herbivore damage. • Control/reduce invasive plant species
3. Discourage waterfowl from using the mitigation area.	No emergent wetland areas will be present on the mitigation site.	Vegetation sampling (See above).	See above.
4. Plant native riparian tree and shrub plant species within the 100-ft buffer along Des Moines Creek.	Survival of planted stock will be 100% at the end of year 1. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Following year 3, tree density will be at least 280 individuals per acre and shrub density will be at least 2,100 individuals per acre. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline. Cover of native trees and shrubs will be at least 80% by monitoring year 15[b]. Cover of non-native invasive species will not exceed 10% at monitoring year 15[c].	Vegetation sampling (See above).	See above.

a Years of normal rainfall will be based on the definition for 'most years' given in the USACE 1987 Manual, annual precipitation in a normal year must be the

same as or greater than precipitation in 5 years out of 10; OR normal rainfall will be the average annual precipitation +/- 1 standard deviation of the mean.

b See Table 4.2-1 for interim cover targets (i.e., from year 3 to year 15).

c See Table 4.2-2 for list of invasive, non-native species to be monitored and controlled on the mitigation site.

Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
Excavated Areas (East and West Basins)			
1. Use a perched water table to establish wetlands at the approximate final grades of: <u>East Basin</u> 41 ft to 38 ft in emergent wetlands 42 ft to 41 ft in shrub wetlands 45 ft to 42 ft in forested wetlands Below 38 ft in open-water wetland <u>West Basin:</u> 42 ft to 44 ft in emergent wetlands 44 ft to 47 ft in shrub wetlands 47 ft to 49 ft in forested wetlands Below 42 ft in open-water wetland	Wetland areas will meet the following hydrology[a] criteria: In forested areas, soils will be saturated within the upper 12 inches for a minimum of 2 weeks during the growing season[b] In shrub areas, soils will be saturated within the upper 6 inches for a minimum of 6 weeks during the growing season[b]. In emergent zones, soils will be saturated to the soil surface for 6 months, including at least the period of March through June.	Measure hydrology using ground water monitoring wells, soil pits, and staff gages	Modify surface drainage features or control elevations of drainage channels. Minor regrading if necessary
2. Plant five forested wetland plant associations that are similar in composition to naturally occurring plant associations. Use native[c] deciduous and evergreen species such as black cottonwood, Oregon ash, red alder, western red cedar, and Sitka spruce. Forest communities will have a native shrub understory with species such as salmonberry, twinberry, red-osier dogwood, red elderberry, willows, and vine maple.	Forest wetlands will cover at least 36 acres of the mitigation site. Upland forest habitat will be established on at least 15 acres of the mitigation site.	Measured using record surveys, vegetation monitoring, and mapping. Verify areas available for vegetation zones on completion of grading and prior to planting.	Replant as necessary to achieve desired vegetation. Adjust planting areas to match as-built grades and planned vegetation zones.

Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
3. Plant native tree species at densities greater than 280 trees per acre. Plant native shrub species in forested communities at densities greater than 1,800 plants per acre.	Forest wetlands will have at least 80% cover[d] of native species by monitoring year 15. Forest wetlands will have no more than 10% cover of non-native invasive[e] species by monitoring year 15. At the end of Year 1, survival of planted stock will be 100%. Average survival of planted stock will be at least 80% in the first 3 monitoring years. At Year 3, and for any monitoring year after Year 3, forested areas will have multiple strata, tree species density will be at least 280 trees per acre in forested wetland areas and shrub density will be at least 1,800 individual plants per acre in areas of the forested wetland that are planted with shrubs (i.e., over 25% to 50% of the area). By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	Verify using record surveys and vegetation monitoring. Vegetation sampling (plots, transects, or plotless techniques) to determine plant mortality, density, cover, and presence of invasive species. Vegetation analysis will employ statistically valid sampling and analysis procedures.	Replant as necessary to meet required density. If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material. Install protective collars to reduce herbivore damage. Control/reduce non-native invasive species. Implement integrated weed management plan, which may include test plots to evaluate potential control methods, mechanical removal, manual controls (i.e., chopping, digging) mowing, mulching, biological control, and/or herbicides.

Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

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Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
4. Plant an association of native shrub wetland species that is similar in composition to naturally occurring shrub wetlands, including species such as Pacific willow, Hooker's willow, Sitka willow, red-osier dogwood, and twinberry.	Shrub wetlands will cover at least 6.0 acres of the mitigation site. Species composition in the shrub wetland will include at least a 5% cover of each native species planted. At the end of Year 1, survival of planted stock will be 100%. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Following year 3, shrub density will be at least 2,100 plants per acre in shrub wetland areas. Cover of native species will be at least 80% by monitoring year 15[d]. Shrub areas will have no more than 10% cover of non-native invasive[e] species by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	See above.	See above.

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Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

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Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
5. Plant an association of native emergent wetland species similar in composition to naturally occurring emergent wetlands. Use native species that are suited to seasonally and/or permanently flooded conditions, such as water parsley, hardstem bulrush, and common spike rush.	Emergent wetlands and open-water habitat will cover at least 6.8 acres of the mitigation site. Native emergent wetland species will contribute at least 90% of plant cover in areas planted with emergent species by monitoring year 15[d].	See above.	See above.
6. Plant native emergent species in approximately 0.05-acre monotypic patches.	Species composition in the emergent wetland will include at least a 5% cover of each native species planted. Emergent areas will have no more than 10% cover of non-native invasive[e] species by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	See above.	See above.
7. Provide year-round shallow water with patches of emergent vegetation as feeding habitat for dabbling duck species.	Permanently flooded wetlands (at least 0.59 acres) will have shallow-water habitat (<12 inches deep during the summer months) near the edges. Open water, shallow aquatic bed areas will cover at least 0.59 acres.	Hydrologic monitoring and vegetation surveys.	Replant or minor regrading as necessary.
8. Provide ponded water areas for waterfowl	Ponded water at least 26 inches deep will	Hydrologic monitoring.	Minor regrading as necessary.

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Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

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Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
resting habitat.	occur in open areas of at least 1 acre from December through May.		
9. Plant forested wetland adjacent to shrub, emergent, and open-water habitats.	Forested vegetation with trees at densities of 280 stems per acre will occur within 50 feet of the edge of flooded emergent wetland areas for at least 200 linear feet	Vegetation monitoring, site mapping.	Replant as necessary.
10. LWD (stumps and logs of native species) placed throughout the forested wetland to provide year-round cover for small mammals. Low hummocks constructed in the shrub wetland areas to provide non-saturated soils for burrowing small mammals.	LWD placed at densities of 50 pieces per acre (approximately 25 ft on-center). LWD pieces will be at least 6 ft in length and at least 1 ft in diameter at the narrowest part; 25% of the LWD will be greater than 10 ft long and greater than 2 ft in diameter at the narrowest end. Root wads will be at least 4 ft long and 1 ft in diameter at the stump end. Shrub hummocks (with a minimum area of 150 ft^2 at elevation 43 ft) at least 4 per acre in the shrub zone.	As-built surveys for wood placement and topography. As-built surveys to verify grades; vegetation surveys. Wildlife surveys.	Supplement with more wood as necessary.
11. Provide attachment substrate for breeding amphibian species in areas of	At least 50% of live and dead stems in ponded emergent wetland areas will be	Vegetation surveys.	Replant as necessary.

Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

DRAFT

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
ponded water.	species with stem diameters less than 0.25 inch.		
Existing Wetland			
12. Enhance habitat functions of existing wetland.	Plant sections of the existing wetland with native trees and shrubs at densities of at least 2,100 individual plants per acre for shrubs and at least 280 stems per acre for native trees. At the end of Year 1, survival of planted stock will be 100%. Average survival of planted stock in the enhanced wetland will be at least 80% during the first 3 monitoring years. Cover of native species in the enhanced wetland will be at least 80% by monitoring year 15[d]. Cover of non-native invasive[e] species will be no more than 10% by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.	Vegetation sampling (plots, transects, or plotless techniques) to determine plant mortality, density, cover, and presence of invasive species.	If standards are not met: Select species that are better adapted to existing hydrologic conditions. Install additional plant material. Install protective collars to reduce herbivore damage. Control/reduce non-native invasive species. Implement integrated weed management plan, which may include test plots to evaluate potential control methods, use of mechanical removal, manual controls (i.e., chopping, digging) mowing, mulching, biological control, and/or herbicides
Buffers			
13. Establish a 100-ft-wide forested buffer around the perimeter of the mitigation site. The buffer will be densely planted with	At the end of Year 1, survival of planted stock will be 100%. Average survival of planted stock in the buffer will be at least	See above.	See above.

Table 7.7-1. Final performance standards, evaluation approach, and contingency measures for the Auburn wetland mitigation project.

DRAFT

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
native trees and shrubs to provide site protection and discourage access to the site by people or domestic animals.	80% during the first 3 monitoring years. Cover of native species in the buffer will be at least 80% by monitoring year 15[d]. Cover of non-native invasive[e] species will be no more than 10% by monitoring year 15. By the end of year 3, plant diversity in each stratum will not decrease by more than 10% from the number and type of plants installed at baseline.		
14. Screen the wetland from off-site areas.	Forest and shrub buffers (100-ft-wide) will screen the wetland from off-site, adjacent properties (i.e., lateral views are 100% obscured).	Vegetation surveys.	Replant as necessary.

a All hydrologic criteria (water depths, soil saturation, etc.) must be met during years of normal rainfall; years of normal rainfall will be based on the definition for 'most years' given in the USACE 1987 Manual; annual precipitation in a normal year must be the same as or greater than precipitation in 5 years out of 10; OR normal rainfall will be the average annual precipitation +/- 1 standard deviation of the mean.

b Growing season as defined by the NRCS: portion of year when soil temperatures at 19.7 inches below soil surface are higher than biological zero (i.e., 5°C. From King County Soil Survey, this period is assumed to begin March 1 and is between 190 to 220 days in portions of the County near Puget Sound.

c Native species are those defined as native to the Pacific Northwest per Hitchcock and Cronquist, 1973.

d See Table 4.2-1 for interim percent cover targets for the mitigation site (i.e., between years 1 and 15).

e See Table 4.2-2 for list of non-native invasive species to be monitored and controlled on the mitigation site.

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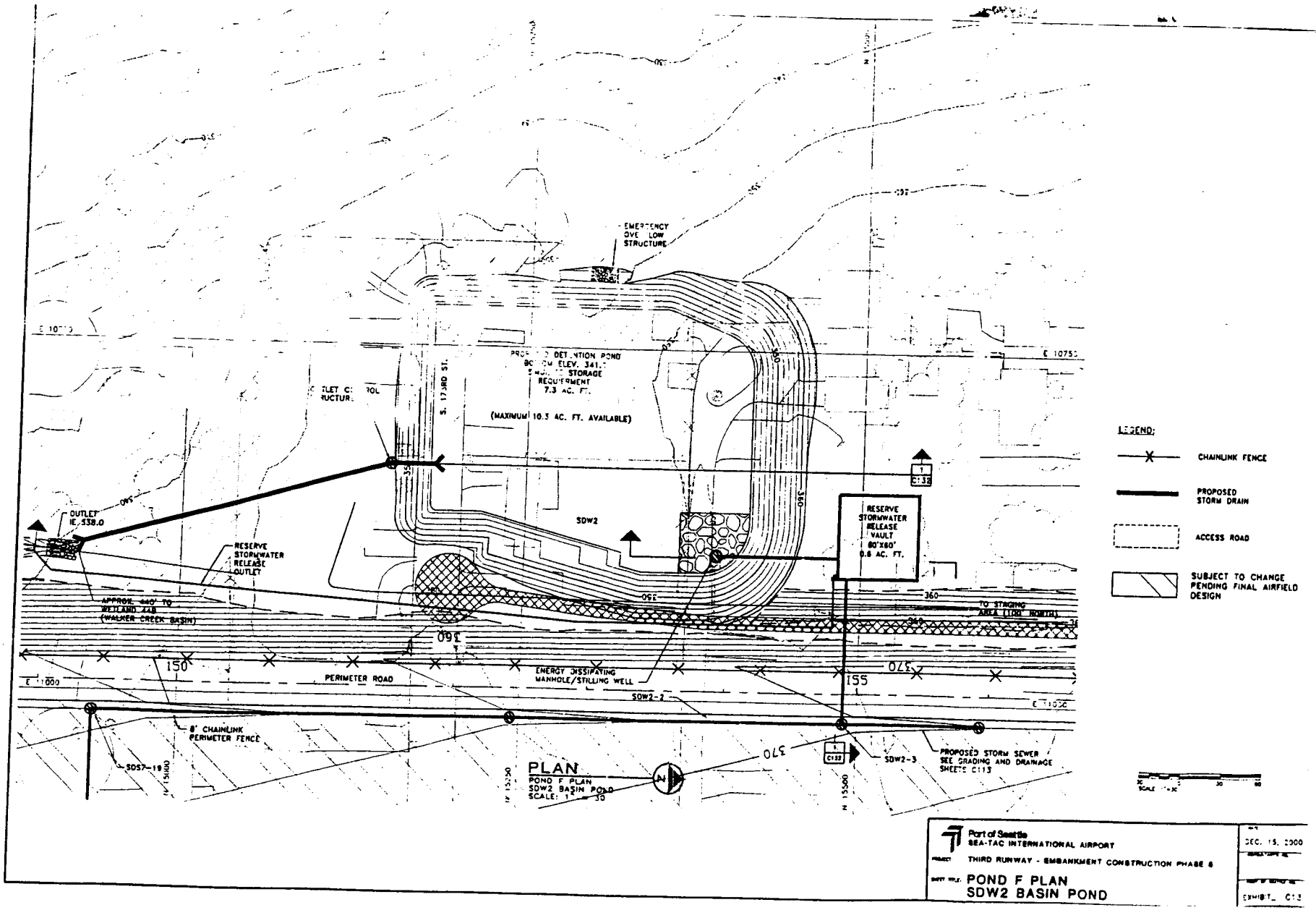

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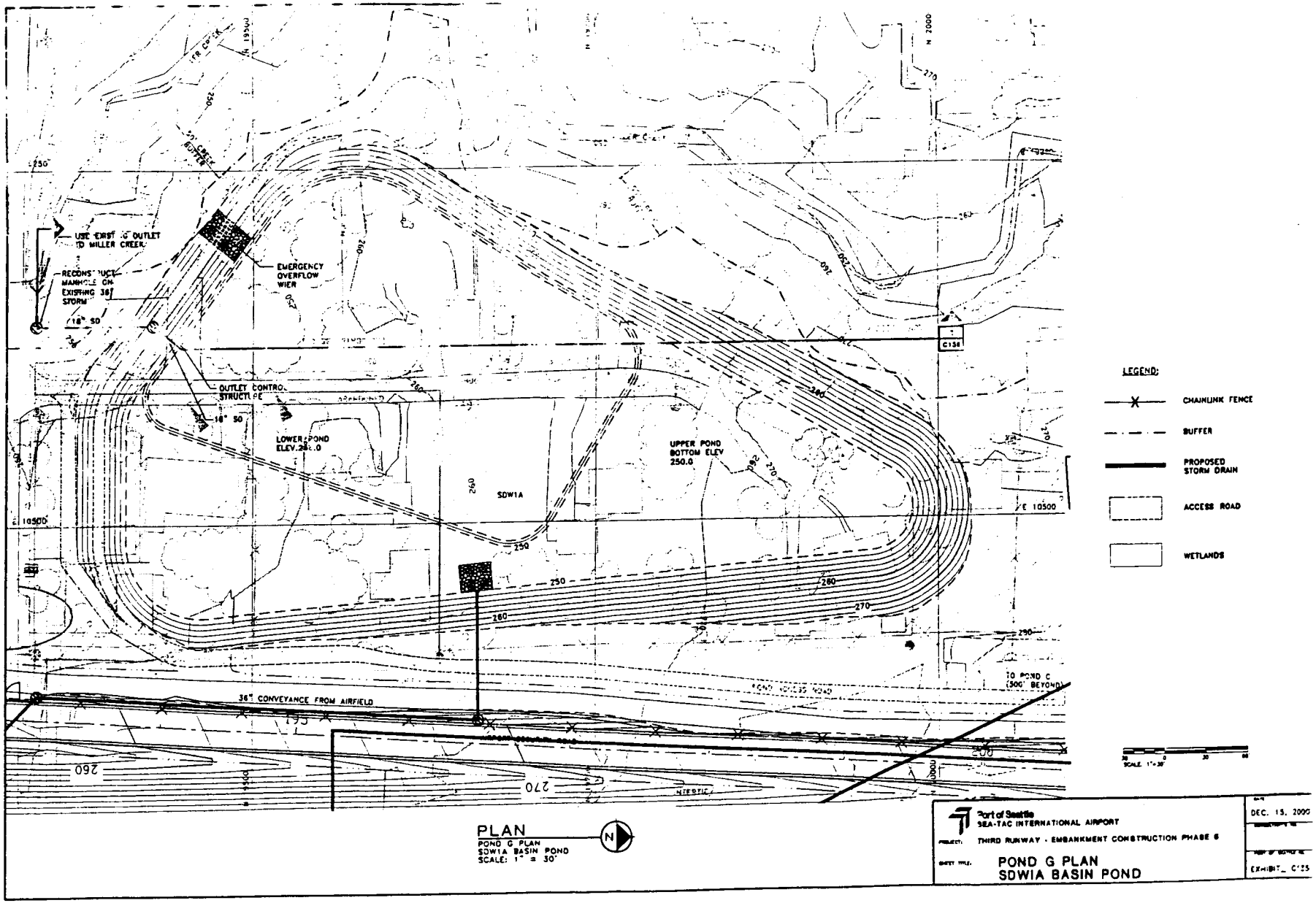

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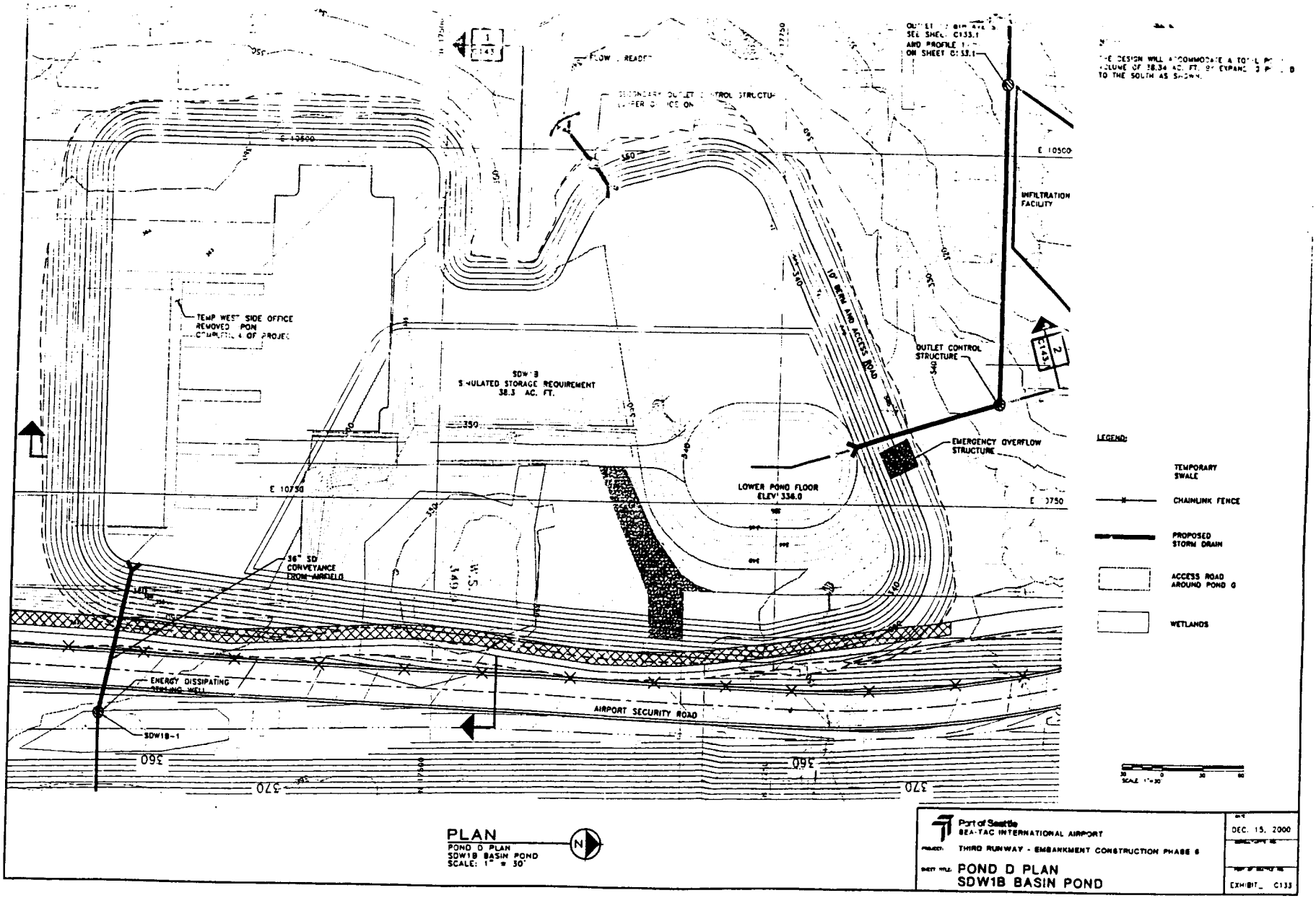

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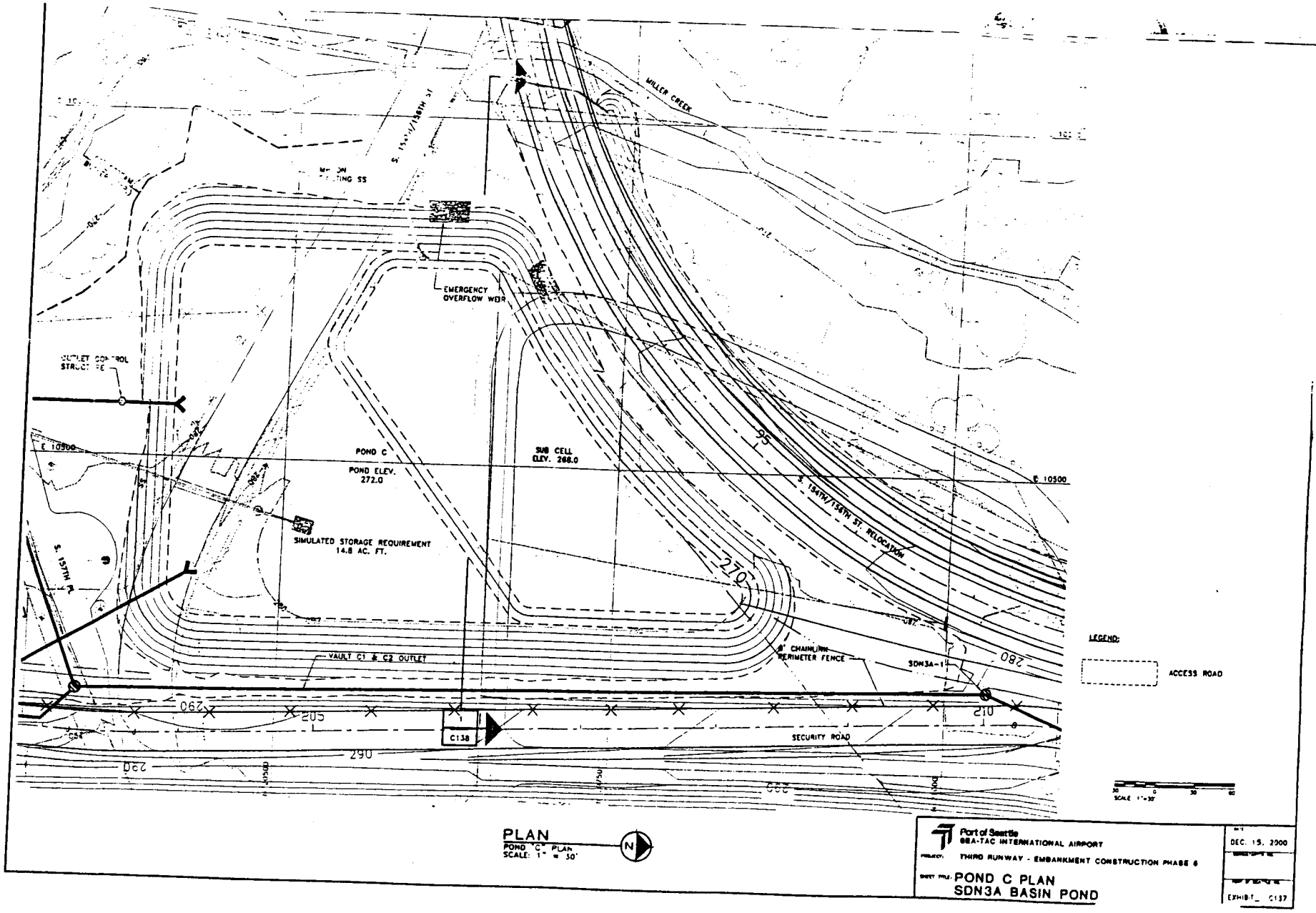

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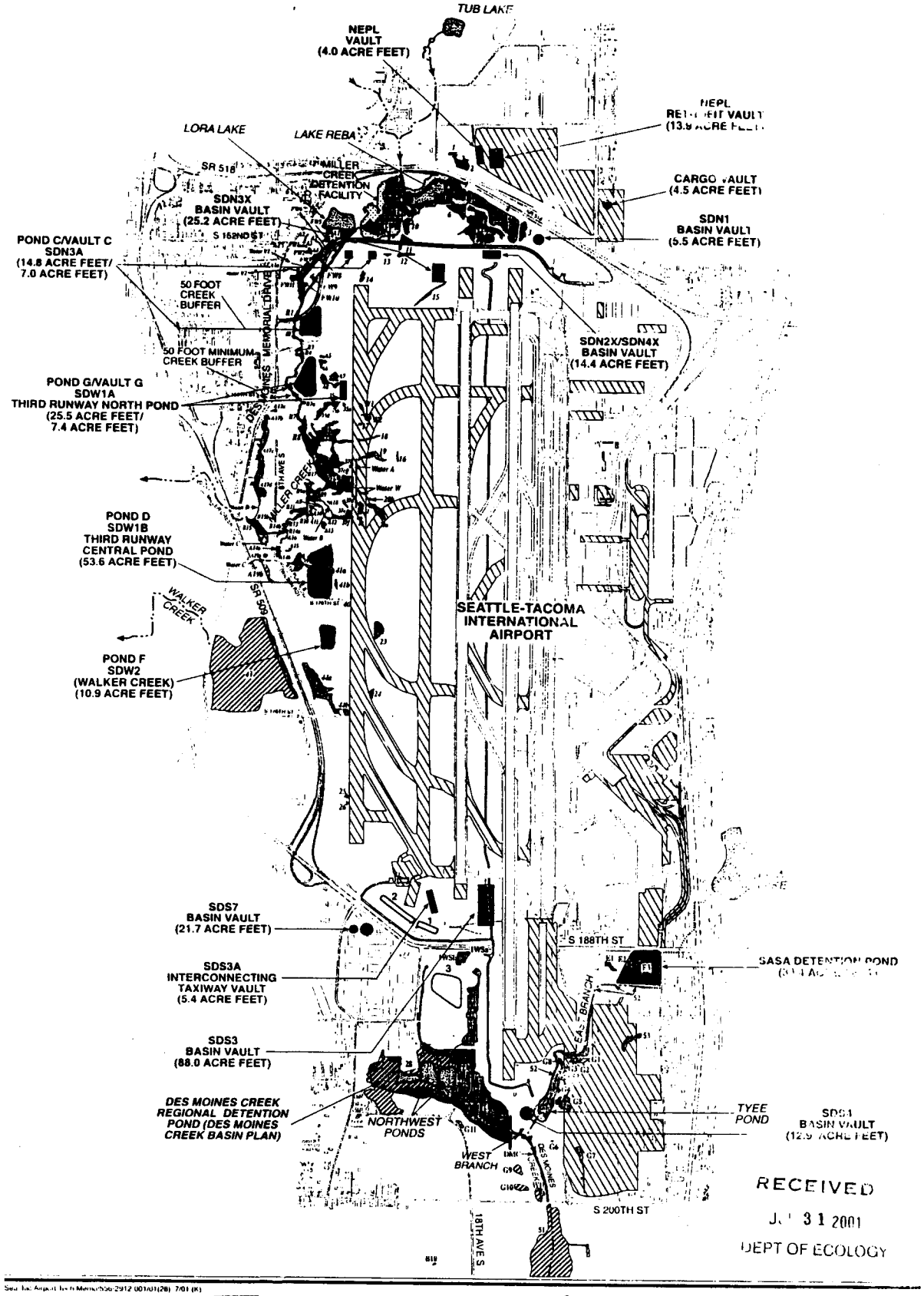

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