Gresham Smith

Genuine Ingenuity

This presentation was prepared for Tennessee Department of Environment & Conservation for general informational purposes related to drought mitigation. It reflects information, assumptions, and conditions available as of December 2025 and is preliminary in nature. It should not be relied upon for pricing, budgeting, procurement, design, construction, permitting, or investment decisions. No representation or warranty, express or implied, is made as to completeness, accuracy, or fitness for a particular purpose.

Duck River Drought Mitigation

Columbia Reservoir

Interbasin Transfer

Offstream Storage Reservoirs

Presented by: Craig Parker, PE and Becky Higgins, PE, CFM

Gresham Smith

Columbia Reservoir

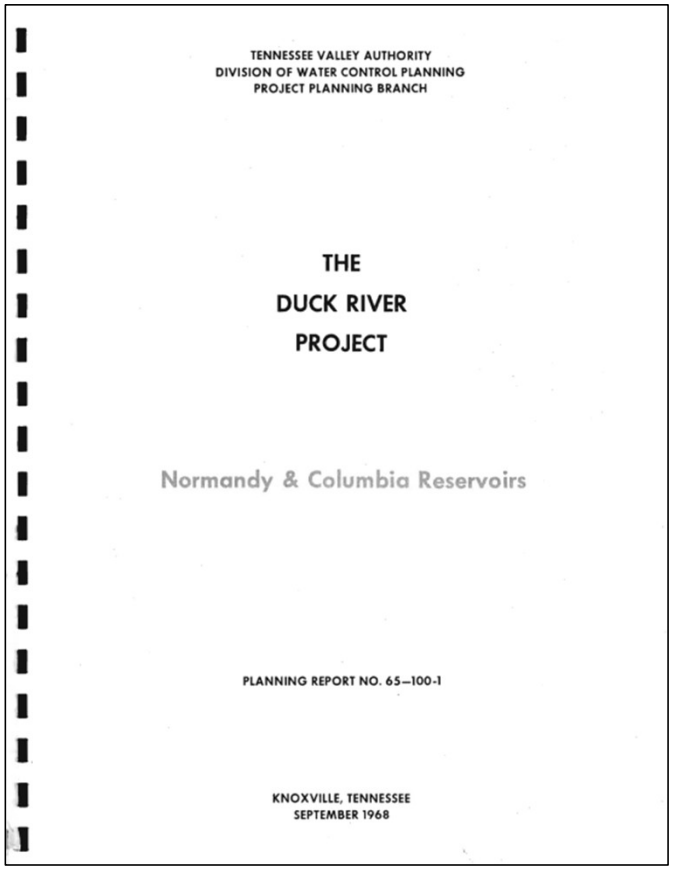
Columbia Reservoir Study

Study Parameters

- Determine inundation area
- Evaluate total land inundated
- Evaluate land use breakdown of inundated land
- Develop high level cost estimate for construction, land acquisition and mitigation

Assumptions

- Columbia Dam location remains in location previously evaluated in 1968
- Maximum Inundation and Winter Pool elevations remain the same as 1968 study
- Dam breech study previously conducted holds true for today's development


TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
PROJECT PLANNING BRANCH

THE
DUCK RIVER
PROJECT

Normandy & Columbia Reservoirs

PLANNING REPORT NO. 65—100-1

KNOXVILLE, TENNESSEE
SEPTEMBER 1968

Columbia Reservoir – Inundated Area

Winter Pool Elevation = 603’

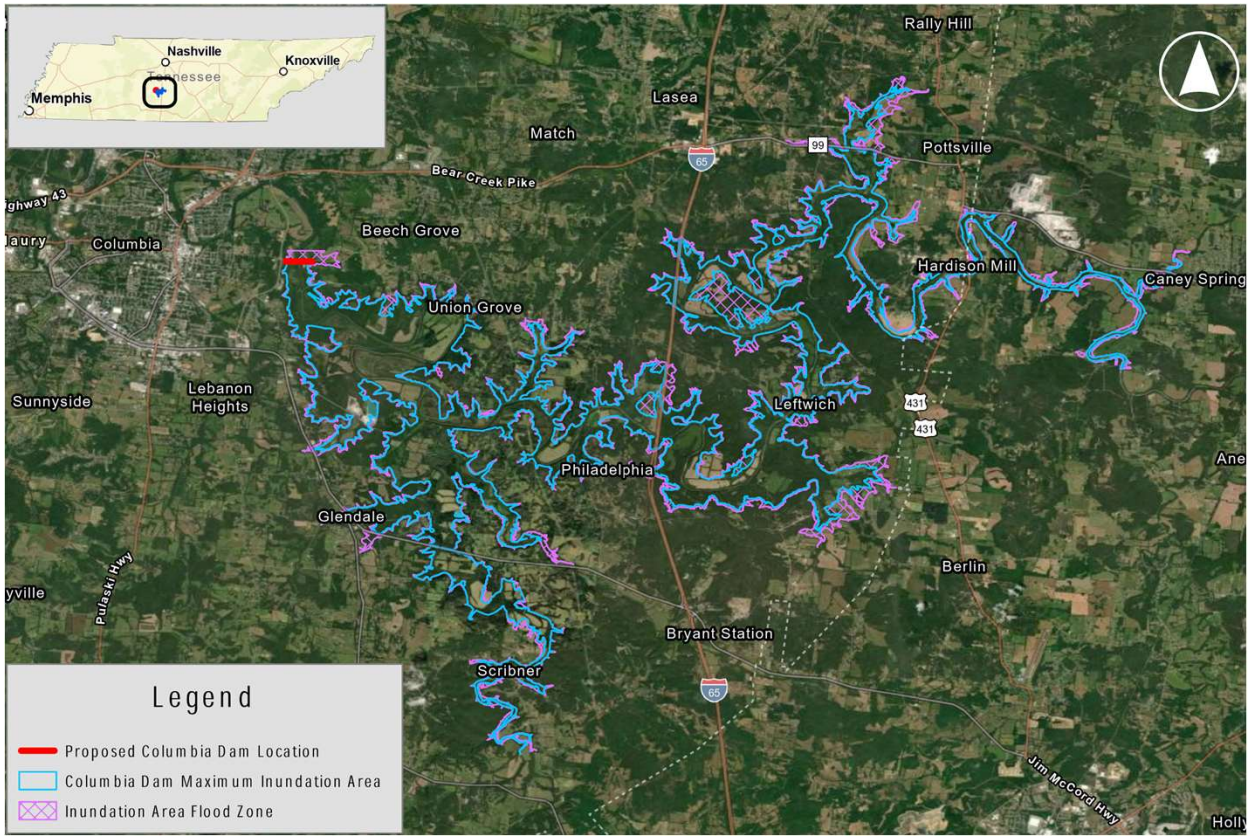
Maximum Inundation Elevation = 630’

Flood Zone = 635’

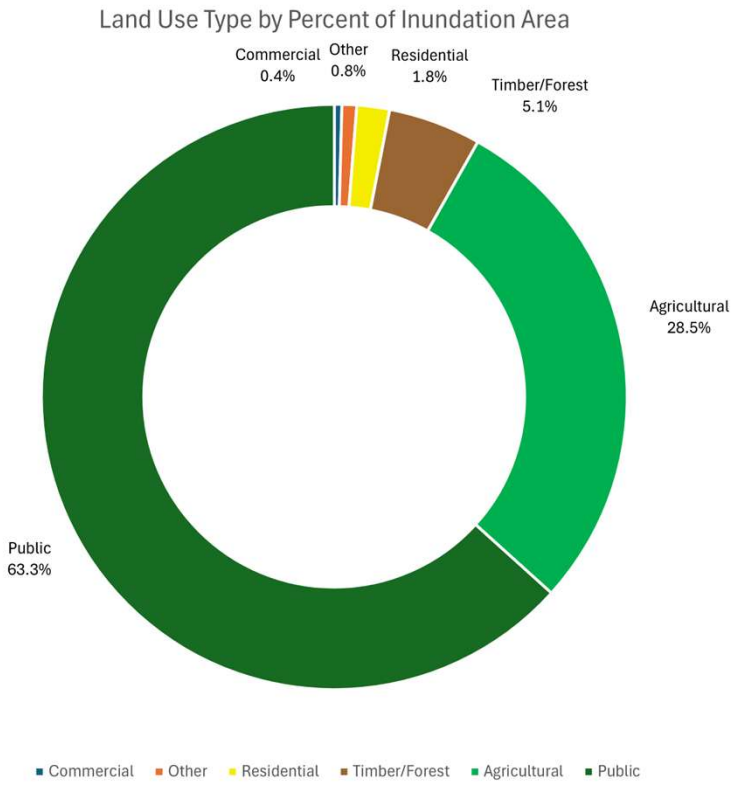
Area Affected by Inundation

Area Type	Acres	Percent of Area
Privately Owned	4,346	36
Publicly Owned	7,776	64
Total*	12,122	100

*Total land affected if full parcels are purchased = 17,186 acres



Columbia Reservoir - Land Use Impacts



- 12,122 acres of land inundated
- Loss of 618 acres of timber/forest area
- Loss of 3,455 acres of farmland
- Loss of 7,673 acres of publicly owned land – primarily conservation area

Columbia Reservoir - Cost and Impacts

Item Description	Cost
Dam Material & Construction	$400,000,000
Raising I-65	$160,000,000
Land Acquisition & Legal Fees	$169,000,000
Wetland Mitigation	$1,700,000
Stream Mitigation	$533,000,000
Conservation Land Mitigation	$115,000,000
Lawsuit & Legal Fees (5%)	$69,000,000
Studies/Engineering Fee (10%)	$138,000,000
Contingency (50%)	$793,000,000
Total	$2.4 Billion

Impacts

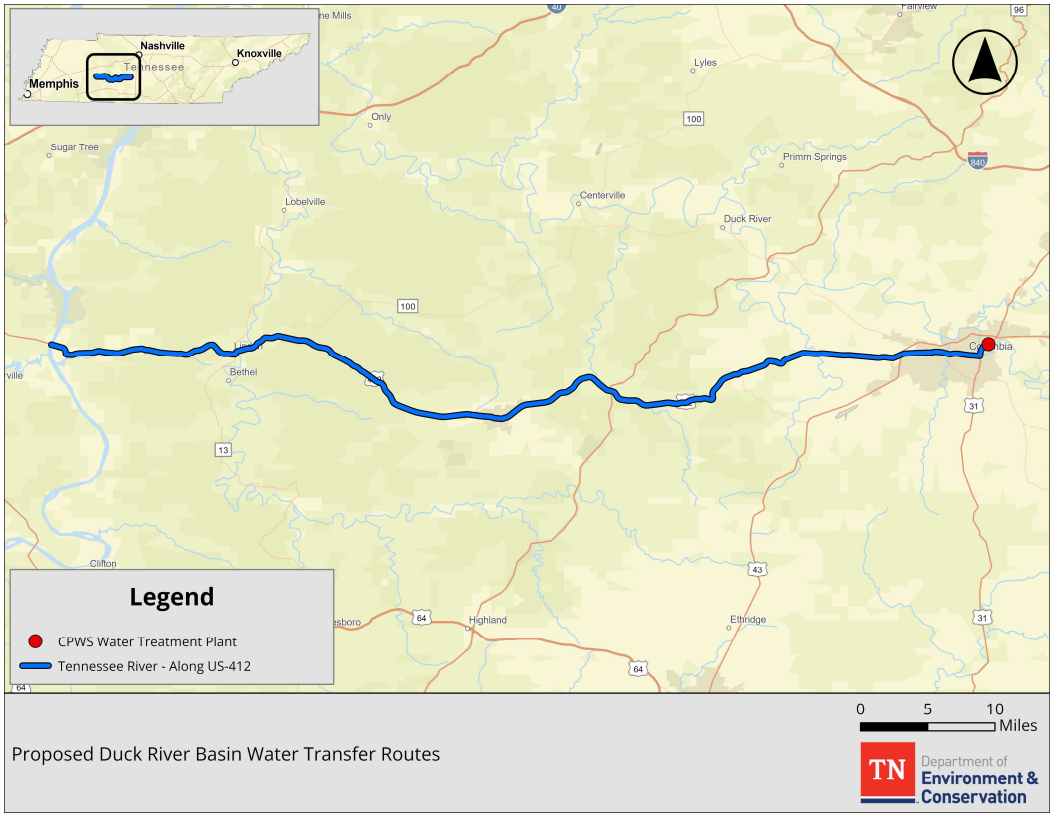
- I-65 over Duck River
- Dam breech floods Columbia hospital district
- Not enough stream mitigation credits
- Karst topography concerns
- Seismic evaluation needed
- Loss of endangered mussel habitat
- Loss of conservation land

Interbasin Transfer

Duck River Basin Transfer Alternatives

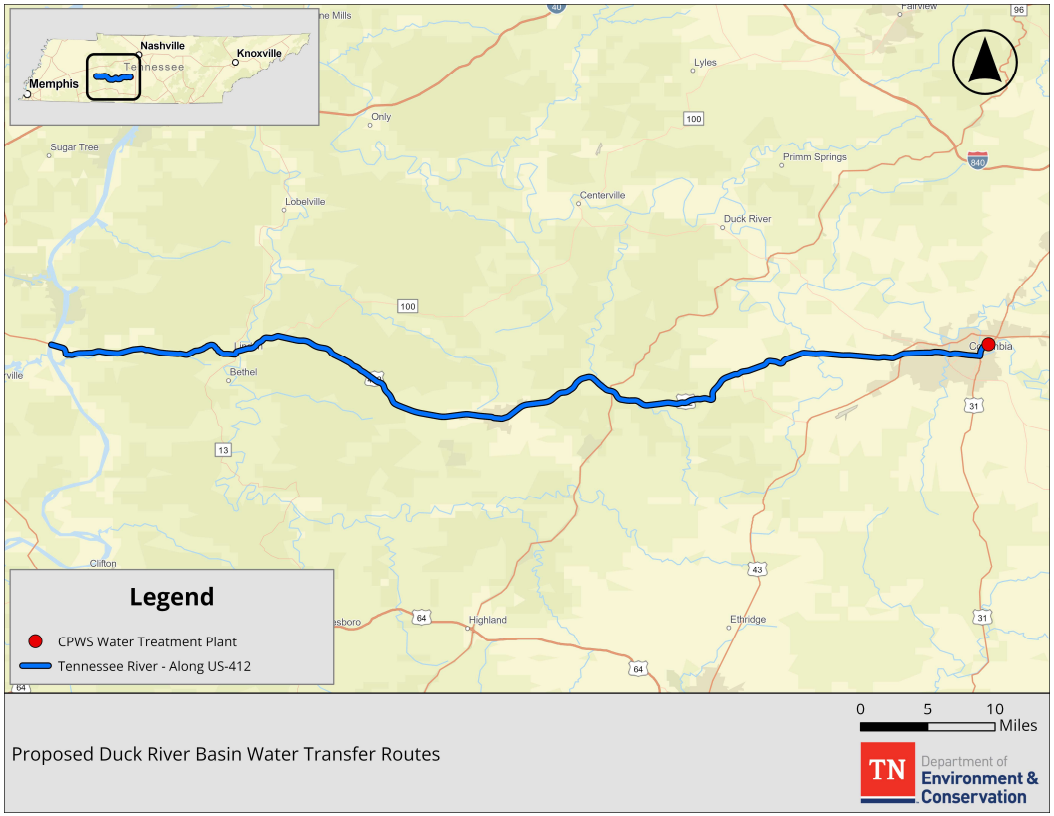
- West routes divert water from the Tennessee or Cumberland River to the CPWS water treatment plant in Columbia
- Tims Ford routes divert water north from Elk River Basin to Duck River Basin near Normandy Reservoir
- TVA power line ROW and TDOT ROW are primary paths to minimize ROW acquisition

Duck River Intrabasin Transfer



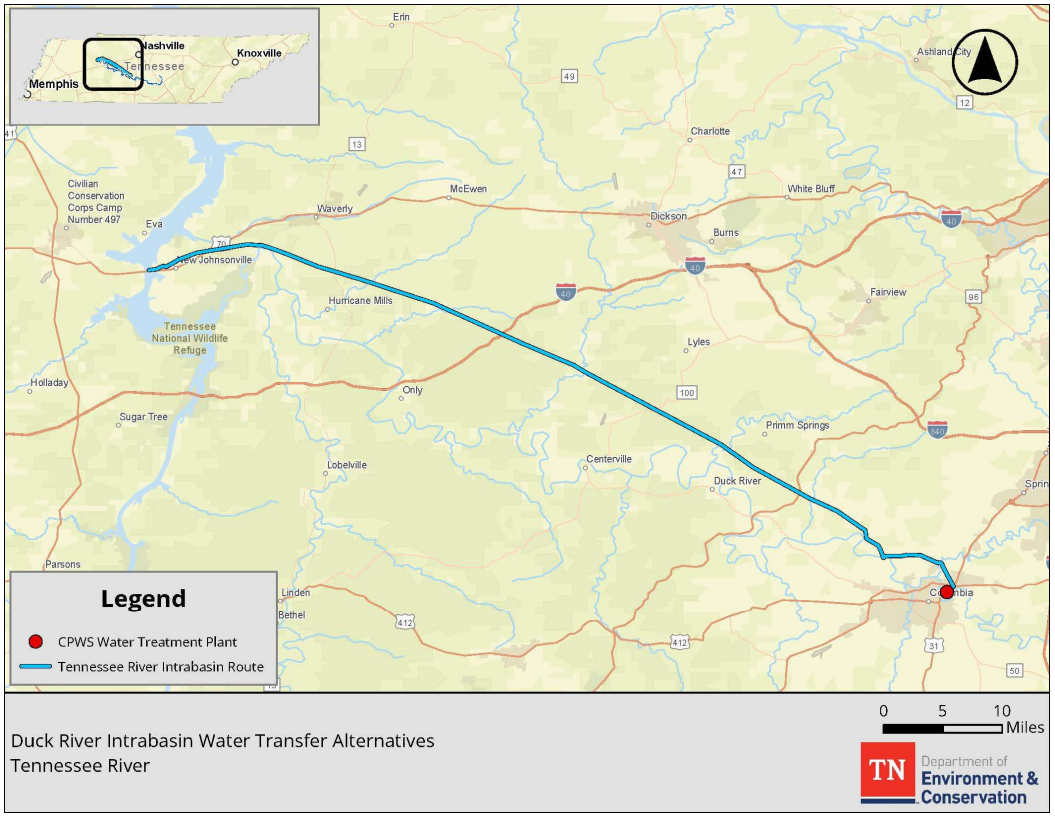
- Diverts water from the Tennessee River near Decaturville, TN
- Utilizes TDOT ROW along US-412
- 65 miles long
- 57 miles (87%) of this route is within existing TDOT ROW
- 8 miles (13%) of this route is within non-TDOT owned parcels

Duck River Intrabasin Transfer



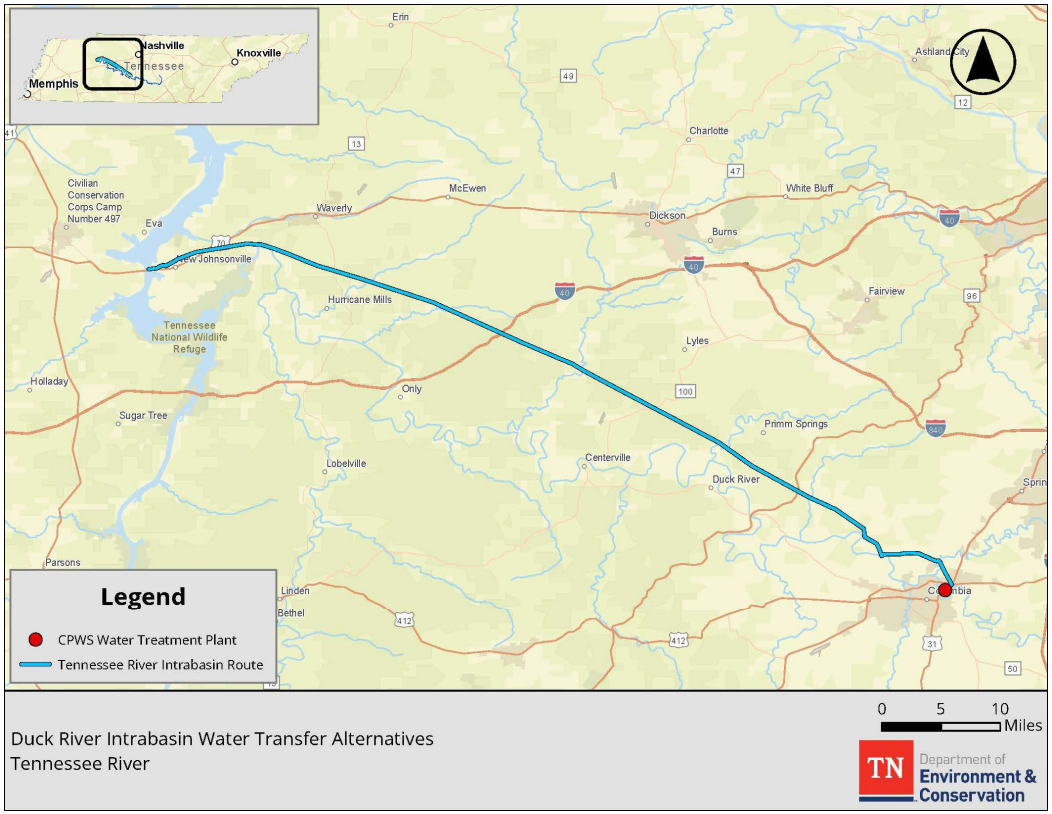
Tennessee River/US-412 Intrabasin Transfer Cost	
Item	**Cost**
Pipeline	$ 660,000,000
Raw Water Intake & PS	$ 128,000,000
Booster Station(s)	$ 64,000,000
Engineering (10%)	$ 85,000,000
Land & Legal ($75/ft)	$ 26,000,000
Contingency (50%)	$ 482,000,000
Sum of Project Costs	**$ 1,445,000,000**

Duck River Intrabasin Transfer



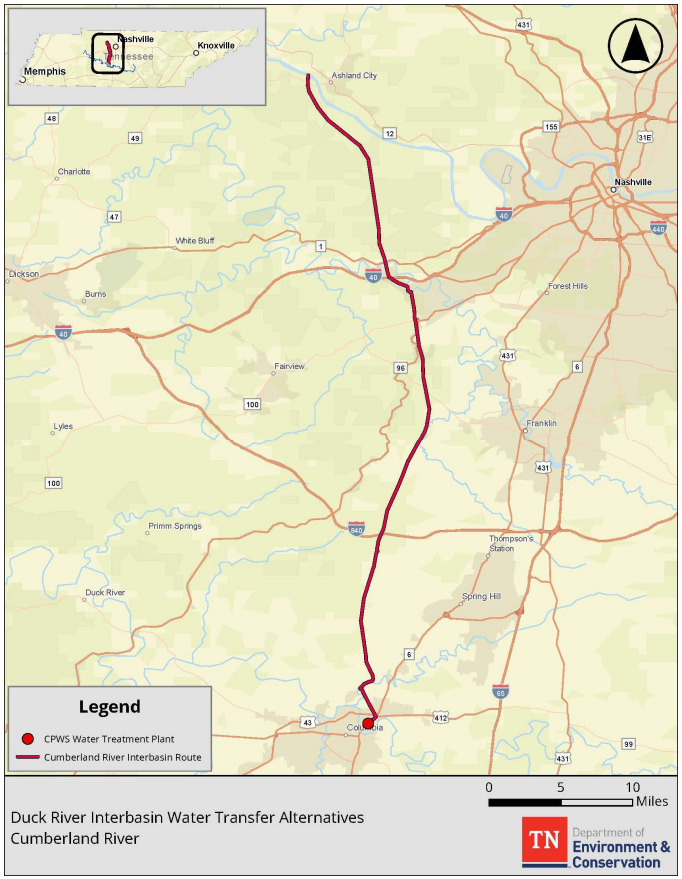
- Diverts water from the Tennessee River at New Johnsonville
- 65 miles long
- This route mainly utilizes TVA ROW

Duck River Intrabasin Transfer



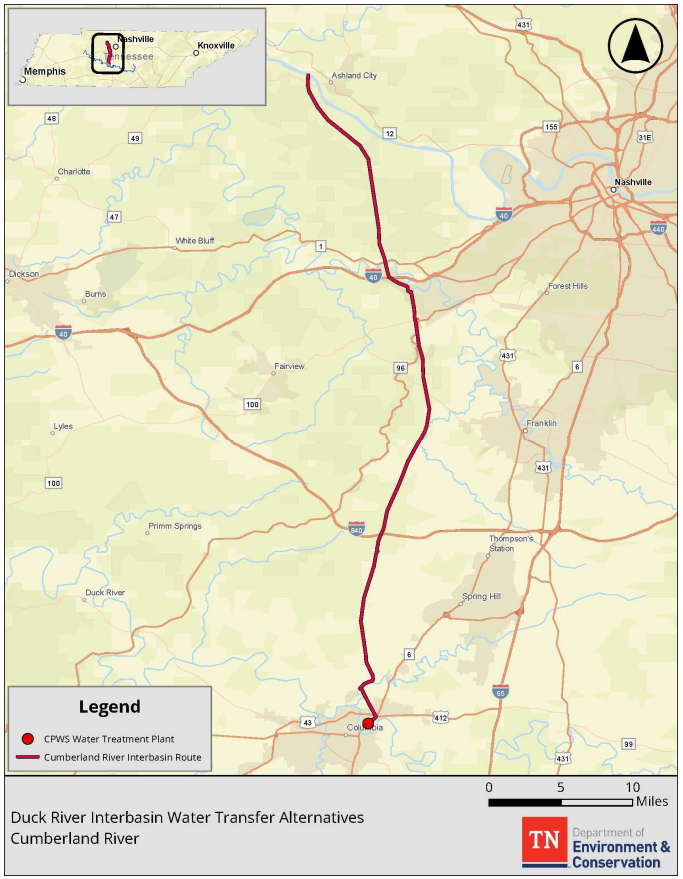
Tennessee River Intrabasin Transfer Cost	
Item	**Cost**
Pipeline	$ 658,000,000
Raw Water Intake & PS	$ 128,000,000
Booster Station(s)	$ 64,000,000
Engineering (10%)	$ 85,000,000
Land & Legal ($75/ft)	$ 26,000,000
Contingency (50%)	$ 480,000,000
Sum of Project Costs	**$ 1,441,000,000**

Duck River Interbasin Transfer



- Diverts water from the Cumberland River downstream of Nashville
- 49 miles long
- This route mainly utilizes TVA ROW

Duck River Interbasin Transfer



Cumberland River Interbasin Transfer Cost	
Item	**Cost**
Pipeline	$ 493,000,000
Raw Water Intake & PS	$ 128,000,000
Booster Station(s)	$ 64,000,000
Engineering (10%)	$ 69,000,000
Land & Legal ($75/ft)	$ 19,000,000
Contingency (50%)	$ 386,000,000
Sum of Project Costs	**$ 1,159,000,000**

Tims Ford Lake to Duck River Transfer

- Diverts water from Tims Ford Lake to below the Normandy Dam
- Utilizes a mix of TDOT ROW and TVA ROW
- 28 miles long
- 9 miles (32%) of this route is within existing TDOT ROW
- 19 miles (68%) of this route are within parcels with existing TVA ROW

Tims Ford Lake to Duck River Transfer

Tims Ford Lake to Duck River Transfer Cost	
Item	**Cost**
Pipeline	$ 287,000,000
Raw Water Intake & PS	$ 128,000,000
Booster Station(s)	$ 64,000,000
Engineering (10%)	$ 48,000,000
Land & Legal ($75/ft)	$ 11,000,000
Contingency (50%)	$ 269,000,000
Sum of Project Costs	**$ 807,000,000**

Tims Ford Lake to Normandy Reservoir Transfer

- Diverts water from Tims Ford Lake into Normandy Lake
- Utilizes a mix of TDOT ROW and TVA ROW, avoiding Arnold Air Force Base
- 21 miles long
- 15 miles (71%) of this route is within existing TDOT ROW
- 6 miles (29%) of this route are within parcels with existing TVA ROW

Tims Ford Lake to Normandy Reservoir Transfer

Tims Ford Lake to Normandy Reservoir Transfer Cost	
Item	**Cost**
Pipeline	$ 208,000,000
Raw Water Intake & PS	$ 128,000,000
Booster Station(s)	$ 64,000,000
Engineering (10%)	$ 40,000,000
Land & Legal ($75/ft)	$ 8,000,000
Contingency (50%)	$ 224,000,000
Sum of Project Costs	**$ 672,000,000**

Offstream Storage Reservoirs

Offstream Storage Reservoir Study

Study Parameters

- Calculate total water withdrawal from Duck between Columbia and Normandy
- Determine 30-day storage volume required to offset water withdrawal
- Identify preliminary storage locations
- Identify preliminary transmission line route
- Develop high level cost estimate for construction and land acquisition

Assumptions

- Utilized future condition withdrawals provided by TDEC
- Reservoir tie-in grading not accounted for – standardized length/width/depth utilized
- Depths kept to 30 ft or less. No Geotech information considered at reservoir locations.
- Transmission line length utilized is from reservoir to treatment plant. Existing lines not considered for tie-in at this stage.
- Vertical side slopes, potentially concrete lined
- Land acquisitions costs assume full parcel purchase due to grading and side slope unknowns

Storage Volume Calculation

- 1MGD * 30 days = Required Volume (MG)
- 1 MG = 3.07 ac-ft
- Required Volume (ac-ft) ÷ Assumed Depth (ft) = Footprint Area (ac)

Intake Entity	Intake Flowrate (MGD)	Intake Volume for 30 days (MG)	Intake Volume for 30 days (AC-FT)	Area, 20 ft depth (ac)	Area, 30 ft depth (ac)
Columbia Power and Water (Combined)	32	960	2946	147	98
Maury County Water Systems (Proposed)	3	90	276	14	9
Marshall County Board of Public Utilities	3	90	276	14	9
Lewisburg Water System	6	180	552	28	18
Bedford UD	4	120	368	18	12
Shelbyville Power, Water, Sewerage System	10	300	921	46	31
Spring Hill Water Dept	6	180	552	28	18
Total	64	1920	5892	295	196

Offstream Storage Reservoir Study

Reservoir Siting

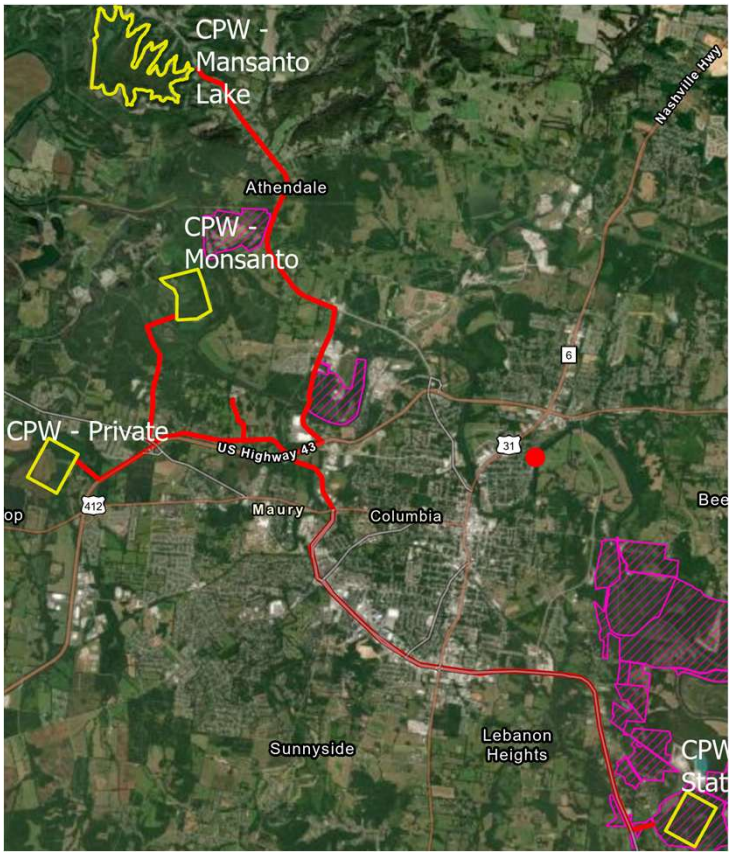
- State/City owned to reduce land acquisition cost
- Near Duck River or Tributary
- Near Treatment facility
- Avoid FEMA Flood Zones
- Avoid wetlands
- Avoid existing buildings
- Flat terrain
- Elevation that allows for 20-30 FT of depth in reservoir while still above normal water level in Duck River
- Locations with existing storage (Quarries, etc.)

Proof of Concept

- City of Spring Hill water reuse dual reservoir - $65-75 Million
- City of Franklin raw water reservoir – $3.9 Million
  - In service 10 years
  - 44 days of storage
  - Shallow with some WQ concerns

Catawba River Treatment Plant
Lancaster, SC
1Billion Gallons
66-MGD Raw Water Pump Station
$35 Million (2019)

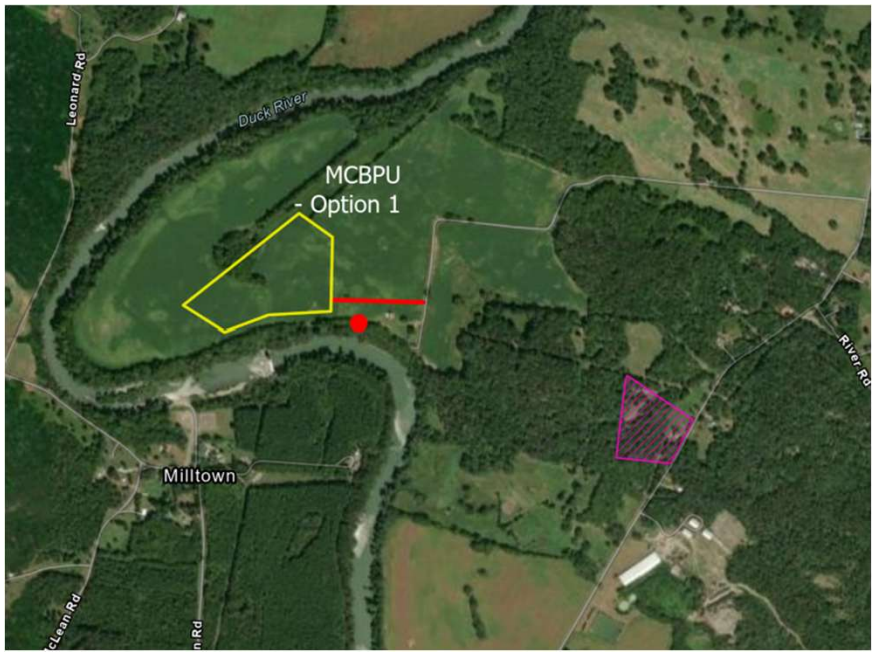
Offstream Storage Reservoir –
Columbia Power and Water



Entity	Intake Flowrate (MGD)	Storage Days	Reservoir Depth (FT)	Reservoir Area (AC)
Columbia Power and Water	32			
Option 1 – Private Property		30	20	147
Option 2 – Monsanto Land		30	20	147
Option 3 – State Owned Land		30	20	147
Option 4 – Mansanto Lake		180	50	354

- Average Basin Cost Estimate - $336,000,000
- Monsanto basin will require additional land remediation

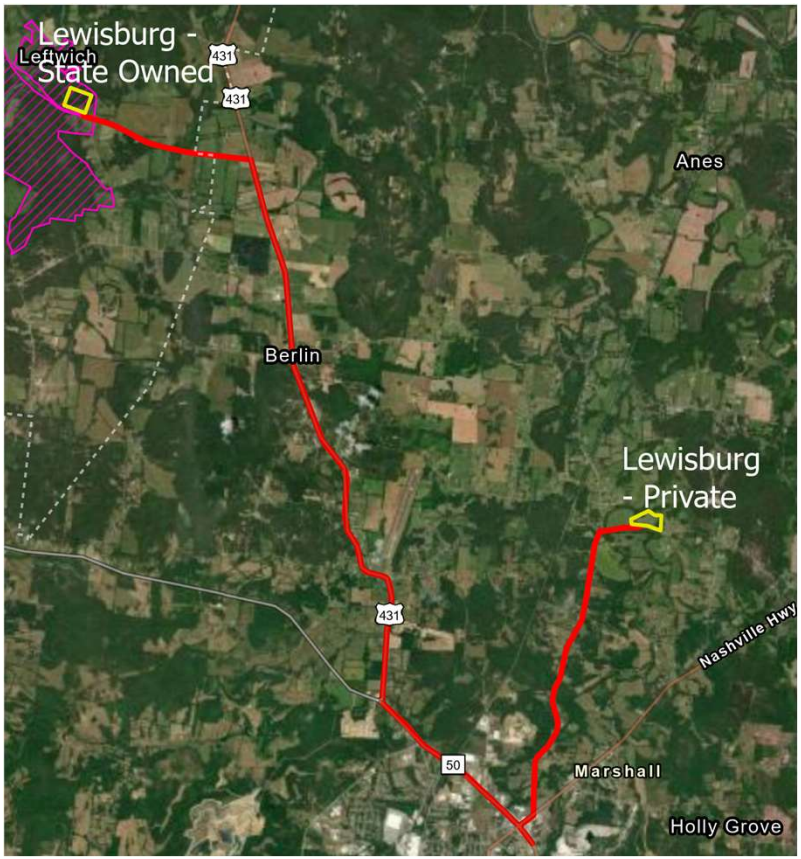
Offstream Storage Reservoir –
Marshall County Board of Public Utilities



Entity	Intake Flowrate (MGD)	Storage Days	Reservoir Depth (FT)	Reservoir Area (AC)
Marshall County BPU	3			
Option 1		30	20	14

- Basin Cost Estimate - $31,000,000

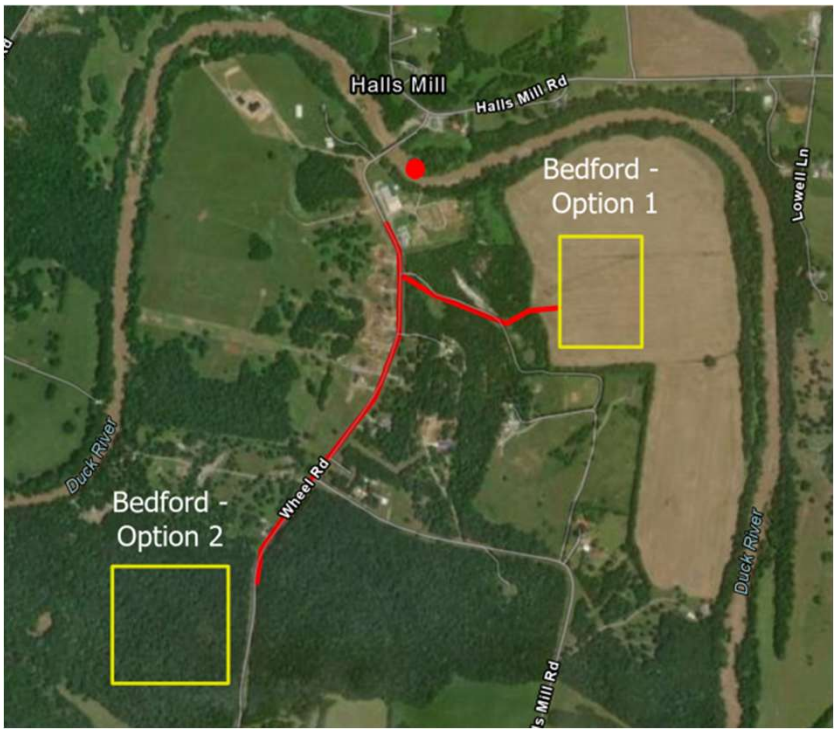
Offstream Storage Reservoir –
Lewisburg Water System



Entity	Intake Flowrate (MGD)	Storage Days	Reservoir Depth (FT)	Reservoir Area (AC)
Lewisburg Water System	6			
Option 1 – State Owned Land		30	20	25
Option 2 – Crawford Property		30	25	22

- Average Basin Cost Estimate - $92,000,000

Offstream Storage Reservoir –
Bedford UD



Entity	Intake Flowrate (MGD)	Storage Days	Reservoir Depth (FT)	Reservoir Area (AC)
Bedford UD	4			
Option 1		30	30	12
Option 2		30	20	18

- Average Basin Cost Estimate - $40,000,000

Offstream Storage Reservoir –

Shelbyville Power, Water, Sewerage System

Entity	Intake Flowrate (MGD)	Storage Days	Reservoir Depth (FT)	Reservoir Area (AC)
Shelbyville PWSS	10			
Option 1 – City Owned Land		30	30	31
Option 2 – Abandoned Quarry		9	20	14

- Average Basin Cost Estimate - $101,000,000

Offstream Storage Reservoir – Cost Breakdown

Intake Entity	Pipe Cost	Reservoir Cost	Raw Water Intake & Pump Station Cost	Pump Station Out Cost	Land Cost	Engineering (10%)	Contingency (50%)	Total
Columbia Power and Water								
Option 1 - Private Property	$ 26,078,976	$ 88,200,000	$ 64,000,000	$ 64,000,000	$ 15,520,800	$ 19,379,978	$ 96,899,888	$ 310,000,000
Option 2 - Monsanto Land	$ 32,376,960	$ 88,200,000	$ 64,000,000	$ 64,000,000	$ 17,426,100	$ 20,200,306	$ 101,001,530	$ 324,000,000
Option 3 - State Owned Land	$ 81,075,456	$ 88,200,000	$ 64,000,000	$ 64,000,000	$ -	$ 23,327,546	$ 116,637,728	$ 374,000,000
Marshall County Board of Public Utilities								
Option 1	$ 354,816	$ 8,400,000	$ 6,000,000	$ 6,000,000	$ 4,558,800	$ 1,931,362	$ 9,656,808	$ 31,000,000
Lewisburg Water System								
Option 1 - State Owned Land	$ 37,179,648	$ 16,800,000	$ 12,000,000	$ 12,000,000	$ -	$ 6,597,965	$ 32,989,824	$ 106,000,000
Option 2 - Private Property	$ 14,674,176	$ 16,500,000	$ 12,000,000	$ 12,000,000	$ 4,906,800	$ 4,808,098	$ 24,040,488	$ 77,000,000
Bedford UD					$ -			
Option 1	$ 1,045,440	$ 10,800,000	$ 8,000,000	$ 8,000,000	$ 3,564,100	$ 2,340,954	$ 11,704,770	$ 38,000,000
Option 2	$ 1,869,120	$ 10,800,000	$ 8,000,000	$ 8,000,000	$ 4,671,900	$ 2,534,102	$ 12,670,510	$ 41,000,000
Shelbyville Power, Water, Sewerage System								
Option 1 - City Owned Land	$ 12,672,000	$ 27,900,000	$ 20,000,000	$ 20,000,000	$ -	$ 6,057,200	$ 30,286,000	$ 97,000,000
Option 2 - Abandoned Quarry	$ 33,808,896	$ 8,160,000	$ 20,000,000	$ 20,000,000	$ 2,772,400	$ 6,474,130	$ 32,370,648	$ 104,000,000
Assumptions:	$40/in/ft	$30K/ac-ft	$2/GPD	$2/GPD	$29K/ac			

Total Water Withdrawal Offset
= $600,000,000