ORNL/TM-2019/1234

HydroSource Data Dictionary

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March 2019

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE US DEPARTMENT OF ENERGY

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Environmental Sciences Division

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CONTENTS

ACRONYMS

CI	condition index
DAMS	FERC Dam Safety and Inspection's Database
DO	Dissolved Oxygen
DOE	US Department of Energy
EF	existing fleet
EIA	Energy Information Administration
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
ESC	eastern stream classification
EUCG	Electric Utility Cost Group
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GADS	Generating Availability Data System
HMR	Hydropower Market Report
HS	HydroSource component of the HydroSource Data Model
HSDM1	HydroSource Data Model, Version 1
HUC	hydrologic unit code
IIR	Industrial Information Resources (database)
IUCN	International Union for the Conservation of Nature
MRLC	Multi-Resolution Land Characteristics Consortium
NERC	North American Electric Reliability Corporation
NHD	National Hydrography Dataset
NHDPlus	National Hydrography Dataset Plus
NID	National Inventory of Dams
NLCD	National Land Cover Dataset
NPD	non-powered dam
NSD	new stream-reach development
NWIS	National Water Information System
ORNL	Oak Ridge National Laboratory
PCA	power control area
PS	Pumped Storage
R&U	Refurbishments and Upgrades
SMH	Standard Modular Hydropower (Explorer)
USGS	US Geological Survey
WPTO	Water Power Technologies Office

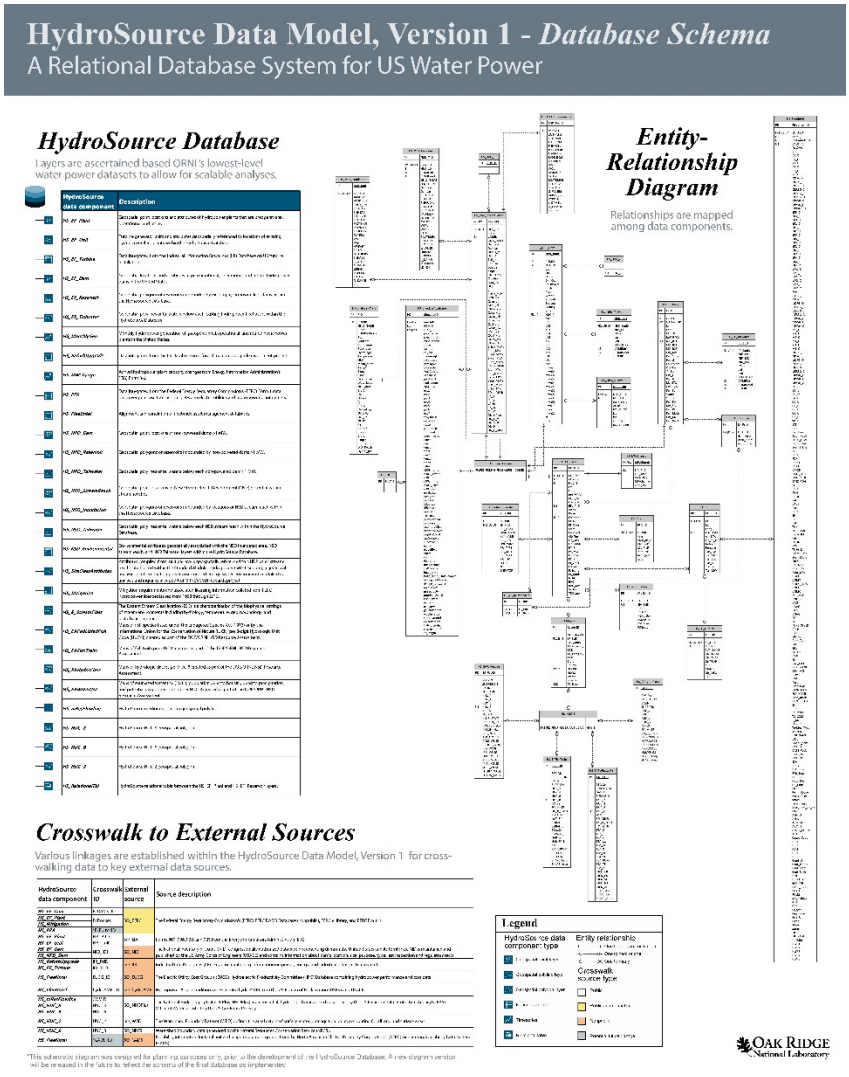
NOMENCLATURE

Abbreviation	Measure	Alternate name	Description
ac-ft	Volume		acre-feet
cfs	Flow	Volumetric flux	cubic feet per second
cm	Length	Length	centimeters
dd	Angle of Arc		decimal degrees
fps	Speed	Velocity magnitude	feet per second
ft	Length		feet
m	Length		meters
MW	Power	Generating capacity	megawatts
MWh	Energy	Energy production	megawatt-hours
%	Ratio	Percent	percent

ABSTRACT

In recent years, Oak Ridge National Laboratory (ORNL) has conducted innovative hydropower research sponsored by the US Department of Energy Water Power Technologies Office (WPTO) to address important questions regarding technology advancement, existing hydropower assets, future hydropower potential, environmental concerns, policy and regulatory decisions, and market trends to support hydropower sustainability in the United States. Data from this research supports a broad and diverse user base including US federal, state, and local governments; national laboratories; hydropower industry; academia; nonprofit organizations; and other end users. The development of a relational database system is needed to ensure proper management of the continuously increasing breadth and depth of these data to guarantee their future value and reliability for advancing hydropower research and supporting the goals and objectives of our partners and US hydropower stakeholders.

During FY 2018, ORNL's HydroSource team reconciled data from ORNL's WPTO-funded projects to create the HydroSource Data Model, Version 1 (HSDM1) schema. The HSDM1 schema provides the essential step in data assimilation toward unifying ORNL's WPTO-funded data into a relational database management system. This report provides technical documentation of the HSDM1 schema to help guide future development and implementation of the HydroSource database system.



1. SDM1 TECHNICAL DOCUMENTATION

Here we introduce the data structure and associations that compose the HydroSource Data Model, Version 1 (*HSDM1) schema*. Our primary intent is to develop a prototype model schema based on existing data resulting from US Department of Energy (DOE) Water Power Technologies Office (WPTO)-funded projects at Oak Ridge National Laboratory (ORNL). This schema provides the necessary step in data assimilation for organizing WPTO-funded ORNL data into a logical framework upon which the HydroSource database system can be effectively planned and developed.

Data components are the primary building blocks that make up the HSDM1 schema. They are essentially different types of data objects that store (1) related sets of *attributes*, and (2) *database indices* (i.e., *primary key, foreign key, external crosswalk key, and potential future key*) that provide connectivity among and beyond data components within HSDM1. We categorize different types of data components within HSDM1 based on their general forms and functions, respectively (i.e., *geospatial point layer*, *geospatial polyline layer*, *geospatial polygon layer*, *nonspatial table*, *time-series*, and *relational table*), to characterize how they explicitly model different types of information.

In the following tables, we group HSDM1 documentation under section headings based on different *research themes* and logical data component groupings. Under each heading, we first summarize top-level information about data components to document and identify their corresponding field names, aliases, types, descriptions, and *confidentiality*. This information allows us to quickly and easily identify and differentiate among major sets of data (i.e., data components) within HSDM1. Next, we document *properties* (i.e., field, alias, unit of measurement, description) of the *database indices* and sets of *attributes* associated with each *data component*. Last but not least, we introduce the *HSDM1 Crosswalk*, which provides capabilities to extend the HSDM1 through key linkages to major external data frameworks that are relevant for supporting US hydropower sustainability. Ultimately, we hope that this documentation will effectively align multiple perspectives to help facilitate the continued development and deployment of the HydroSource database system.

2. EXISTING HYDROPOWER FLEET

HSDM: HS_DG: Summary of existing fleet (EF) data components

Data_Component	Alias	Type	Description
HS_EF_Plant	EF plant	Geospatial point layer	Geospatial point locations and attributes of hydropower plants that are preoperational, operational, and retired
HS_EF_Unit	EF unit	Geospatial point layer	Turbine-generator units and attributes geospatially referenced to locations of existing hydropower fleet plants within the HydroSource Database
HS_EF_Turbine	EF turbine	Nonspatial table	Data integrated from the Industrial Information Resources (IIR) Database on US turbine installations
HS_EF_Dam	EF dam	Geospatial point layer	Geospatial locations and attributes of preoperational, operational, and retired hydropower dams in the United States
HS_EF_Reservoir	EF reservoir	Geospatial polygon layer	Geospatial polygons of reservoirs impounded by existing hydropower fleet dams within the HydroSource Database
HS_EF_Tailwater	EF tailwater	Geospatial polyline layer	Geospatial polylines of tailwaters below each existing hydropower fleet asset within the HydroSource Database
HS_FleetIntel	Hydro fleet intelligence	Nonspatial table	Alignment and correlation of fleetwide asset management databases

HS_EF_Plant: Attribute summary

Field Name	Alias	Unit	Description
EF_PtID	Existing Fleet Plant ID	ID	Unique identification code assigned to each HS_EF_Plant record
EF_DmID	Existing Fleet Dam ID	ID	Unique identification code assigned to each HS_EF_Dam record
COMID	NHDPlus V1 Common Identifier	ID	National Hydrography Dataset Plus (NHDPlus) V1 flowline common identifier
Lat	Latitude	DD	Latitude
Long	Longitude	DD	Longitude
HUC_8	8-Digit HUC	ID	Eight-digit US Geological Survey (USGS) hydrologic unit code (HUC)
ReEDSPCA	ReEDS PCA	N/A	Power control area (PCA) assigned to a plant based on the location of the existing powerhouse
Pt_Type	Plant Type	N/A	Type of hydropower facility
OwType	Plant Ownership Category	N/A	Hydropower plant ownership category
EIA_PtID	EIA Plant ID	ID	Energy Information Administration (EIA) Plant ID
Status	Project Status	N/A	Current status of the hydropower project
Permit	Permit Type	N/A	Type of hydropower permit
FcDocket	FERC Docket Number	ID	Federal Energy Regulatory Commission (FERC) docket number
Pt_Nm	Plant Name	N/A	Plant name
Pt_Own	Plant Owner	N/A	Plant owner
State	USPS 2-letter postal code	N/A	Two-letter US Postal Service abbreviations of US states or associated territories that each powerplant is within
CountyNm	County name	N/A	County the powerplant is within
CityNm	City name	N/A	Neighboring city
HY_MW	Hydropower nameplate capacity	MW	Total capacity from hydraulic turbine-generator units within each plant. Excludes capacity from pumped storage (PS) turbine-generator units. PS turbine-generator units are those which can consume (instead of generating) power to pump water to an upper reservoir for later use
HY_MWh	Hydropower net generation	MWh	Average annual net hydropower generation

HY_Pf	Hydropower plant factor	%	Hydropower plant factor for each plant calculated as (total hydropower net generation—plant consumption)/ (hydropower capacity × hours in a year)
PS_MW	Pumped storage nameplate capacity	MW	Pumped storage nameplate capacity in megawatts for each powerplant
PS_MWh	Pumped storage gross generation	MWh	Pumped storage gross generation in megawatt hours for each powerplant
PS_Pf	Pumped storage plant factor	%	Pumped storage plant factor for each plant
Pt_OnYr	Plant year in service	YYYY	Year that the first generator came online
FcIssue	FERC permit issue date	N/A	FERC date that either a license or exemption was issued
FcExpire	FERC permit expiration date	N/A	FERC license expiration date
Pt_Mode	Mode of operation	N/A	Mode of operation classification of the plant
NERC	NERC region	N/A	North American Electric Reliability Corporation (NERC) region each plant falls within
BAC	Balancing authority code	N/A	Identifier code of the balancing authority for each hydropower plant
BAC_Nm	Balancing authority name	N/A	Name of the balancing authority for each hydropower plant
Sector	Sector name	N/A	Plant-level sector name defined by the EIA
TDOwner	Transmission or Distribution System Owner	N/A	Transmission or distribution system owner of the energy generated by the hydropower plant

HS_EF_Unit: Attribute summary

Field Name	Alias	Unit	Description
EF_UnID	Existing fleet unit id	ID	Unique identification code assigned to each HS_EF_Unit record
EF_PtID	Existing fleet plant id	ID	Unique identification code assigned to each HS_EF_Plant record
Lat	Latitude	DD	Latitude
Long	Longitude	DD	Longitude
EIA_UnID	EIA unit id	ID	EIA turbine-generator unit ID
Gn_MW	Nameplate capacity	MW	Nameplate capacity for each generator
Gn_Yr_IS	Generator Year in Service	YYYY	Year generator came online
RetireYr	Year retired	YYYY	Year generator retired
RehabYr	Year rehabilitated	YYYY	Year turbine rehabilitated
Tur_Typ	Turbine type	N/A	Type of turbine
Tur_Man	Turbine manufacturer	N/A	Turbine manufacturer
Tur_Spd	Turbine speed	rmp	Turbine speed
Tur_h	Turbine rated head	ft	Change in water levels between intake and discharge point
Tur_hp	Turbine power	hp	Turbine power
Tur_MW	Turbine hydraulic capacity	cfs	Maximum turbine hydraulic capacity

HS_EF_Turbine: Attribute summary

Alias	Field Name	Unit	Description
Existing Fleet Unit ID	EF_TrID	ID	Unique identification code assigned to each HS_EF_Turbine record
Existing Fleet Plant ID	EF_UnID	ID	Unique identification code assigned to each HS_EF_Unit record
IIR Plant ID	IIR_TrID	ID	Unique identification code assigned to each turbine-level record within the IIR Database
Plant name	PLT_NAME	N/A	Name of plant
Unit name	UNITNAME	N/A	Name of unit
Unit state	UNITSTATE	N/A	Unit location (state)
Unit capacity	UNITCAP	MW	Capacity of installed unit
Start year	YEAR	N/A	Year in which the new turbine starts operation
Unit manufacturer	MANUF	N/A	Turbine manufacturer
Turbine drive details	DR_INFO	N/A	Turbine drive details
Turbine type	TYPE	N/A	Turbine drive type

HS_EF_Dam: Attribute summary

Alias	Field Name	Unit	Description
Existing Fleet Dam ID	EF_DmID	ID	Unique identification code assigned to each HS_EF_Dam record
FERC DAMS Dam ID	FcDAMS_ID	ID	Unique identifier associated with dams from the FERC Dam Safety and Inspections Database (DAMS)
NHDPlus V1 Common Identifier	COMID	ID	NHDPlus V1 flowline common identifier
Latitude	Lat	DD	Latitude
Longitude	Long	DD	Longitude
8-Digit HUC	HUC_8	ID	Eight-digit USGS HUC
ReEDS PCA	ReEDSPCA	ID	PCA assigned to a plant based on the location of the existing powerhouse
NID_ID1	NID_ID1	ID	Unique identification code assigned to each dam record within the National Inventory of Dams (NID) Database

NID State ID	NID_ID2	ID	State or federal agency identification code for each dam record within the NID Database
NID Structure ID	NID_ID3	ID	Identification code for saddle dams or dike associated with the larger dam project
Dam Name	Dm_Nm	N/A	Name of the dam
Dam Owner Name	Dm_Own	N/A	Owner of the dam
USPS 2-Letter Postal Code	Postal	N/A	Two-letter US Postal Service abbreviations of US states or associated territories each powerplant is within
County Name	CountyNm	N/A	County dam is within
City Name	CityNm	N/A	City dam is within
Year Built	Yr_Built	YYYY	Year the dam was built
Dam Height	Dm_HT	ft	Height of the dam
Dam Length	Dm_LG	ft	Length of the dam
Maximum Storage	MaxSTO	ac-ft	Maximum storage of the dam
Dam Type	Dm_Type	N/A	Type of dam
Dam Purpose	Dm_Pur	N/A	Purpose for the dam
Watersource	Water	N/A	Primary water source of the dam
Annual Mean Flow	Yr_cfs	cfs	Estimated annual mean flow
Drainage Area	Dm_DA	mi^2	Drainage area of the dam
Surface Area	Dm_SA	ac	Surface area of the impoundment at its normal retention level
Residence Time	Dm_RT	day	Residence time, estimated by d × (Reservoir storage in ac×ft)/ (annual mean flow in cfs) d = 0.504 is a unit conversion factor
Mode of Operation	Dm_Mode	N/A	Mode of operation classification for the dam
Diversion	Dm_Div	N/A	Denotes whether or not the dam contains a diversion
Diversion Length	Dm_DivLG	mi	Length of the diversion

HS_EF_Reservoir: Attribute summary

Alias	Field Name	Unit	Description
Existing Fleet Reservoir ID	EF_RsID	ID	Unique identification code assigned to each HS_EF_Reservoir record.
Existing Fleet Dam ID	EF_DmID	ID	Unique identification code assigned to each HS_EF_Dam record.
Dam Distance Kilometers	dam_distkm	km	Nearest distance from dam to edge of reservoir. If intersecting reservoir, then value is 0.
Area Square Kilometers	Area_SQKM	km^2	Reservoir area in square kilometers.
Reservoir Source	res_source	NA	Source of information used to create the reservoir (either NHDPlus V1"Waterbody," NHDPlus V1 "Area," or digitized and converted into polygons from NLCD open water land cover classification.

HS_EF_Tailwater: Attribute summary

Alias	Field Name	Unit	Description
Existing Fleet Tailwater ID	EF_TlID	ID	Unique identification code assigned to each HS_EF_Tailwater record
Existing Fleet Dam ID	EF_DmID	ID	Unique identification code assigned to each HS_EF_Unit record
NID ID	NID_ID1	ID	Official NID ID for the dam
NID State ID	NID_ID2	ID	NID state or federal agency ID for the dam
NID Structure ID	NID_ID3	ID	NID ID for the saddle dam or dike associated with the larger dam project
Dam Name	Water	N/A	Name of dam
Latitude	Lat	Decimal degrees	Latitude of dam
Longitude	Lon	Decimal degrees	Longitude of dam
Length Km	LENGTHKM	Kilometers	Total length of each tailwater in kilometers
COMID Initial	COMIDini	NA	Unique identification code from NHDPlus V1 for each stream reach at the upstream end of the tailwater
COMID End	COMIDend	NA	Unique identification code from NHDPlus V1 for each stream reach at the downstream end of the tailwater
COMID	COMID	NA	Unique identification code from NHDPlus V1 for each stream reach at the location of the dam

HS_FleetIntel: Attribute summary

Alias	Field Name	Unit	Description
Hydro Fleet Intelligence ID	FleetIntel_ID	ID	Unique identification code assigned to each HS_FleetIntel record
Existing Fleet Unit ID	EF_UnID	ID	Unique identification code assigned to each HS_EF_Unit record
EUCG ID	EUCG_ID	ID	Unique identification code assigned to each record within the Electric Utility Cost Group (EUCG) Database
hydroAMP ID	hydroAMP_ID	ID	Unique identification code assigned to each record within the hydroAMP Database
	GADS_ID	ID	
Ownership	PctOwn	PCT	Ownership %
Accumulated Depreciation	AD	1,000s of LCU	Accumulated depreciation
Admin Direct Contracts	A1_C	1,000s of LCU	Admin 1—Direct contracts
Admin Direct Labor	A1_L	1,000s of LCU	Admin 1—Direct labor
Admin Direct Other	A1_O	1,000s of LCU	Admin 1—Direct other
Admin Indirect Contracts	A2_C	1,000s of LCU	Admin 2—In-Direct contracts
Admin Indirect Labor	A2_L	1,000s of LCU	Admin 2—In-Direct labor
Admin Indirect Other	A2_O	1,000s of LCU	Admin 2—In-Direct other
Capital Dam Contracts	I2DRG_C	1,000s of LCU	Investment 2—Capital dam/reservoir/general contracts
Capital Dam Labor	I2DRG_L	1,000s of LCU	Investment 2—Capital dam/reservoir/general labor
Capital Dam Other	I2DRG_O	1,000s of LCU	Investment 2—Capital dam/reservoir/general other
Capital Environ Contracts	I2EREG_C	1,000s of LCU	Investment 2—Capital environmental and regulatory contracts
Capital Environ Labor	I2EREG_L	1,000s of LCU	Investment 2—Capital environmental and regulatory labor
Capital Environ Other	I2EREG_O	1,000s of LCU	Investment 2—Capital environmental and regulatory other

Capital Powerhouse Contracts	I2PWR_C	1,000s of LCU	Investment 2—Capital powerhouse contracts
Capital Powerhouse Labor	I2PWR_L	1,000s of LCU	Investment 2—Capital powerhouse labor
Capital Powerhouse Other	I2PWR__O	1,000s of LCU	Investment 2—Capital powerhouse other
EnvironCulturalContracts	ER3_C	1,000s of LCU	Environmental and regulatory 3—Cultural contracts
Environ Cultural Labor	ER3_L	1,000s of LCU	Environmental and regulatory 3—Cultural labor
Environ Cultural Other	ER3_O	1,000s of LCU	Environmental and regulatory 3—Cultural other
Environ Fish Contracts	ER1_C	1,000s of LCU	Environmental and regulatory 1—Fish and wildlife contracts
Environ Fish Labor	ER1_L	1,000s of LCU	Environmental and regulatory 1—Fish and wildlife labor
EnvironFishOther	ER1_O	1,000s of LCU	Environmental and regulatory 1—Fish and wildlife other
Environ Other Contracts	ER5_C	1,000s of LCU	Environmental and Regulatory 5—Other Contracts
Environ Other Labor	ER5_L	1,000s of LCU	Environmental and Regulatory 5—Other Labor
Environ Other Other	ER5_O	1,000s of LCU	Environmental and Regulatory 5—Other Other
Environ Rec Contracts	ER2_C	1,000s of LCU	Environmental and Regulatory 2—Recreation Contracts
Environ Rec Labor	ER2_L	1,000s of LCU	Environmental and Regulatory 2—Recreation Labor
Environ Rec Other	ER2_O	1,000s of LCU	Environmental and Regulatory 2—Recreation Other
Environ Safety Contracts	ER4_C	1,000s of LCU	Environmental and Regulatory 4—Dam and Public Safety Contracts
EnvironSafetyLabor	ER4_L	1,000s of LCU	Environmental and Regulatory 4—Dam and Public Safety Labor
Environ Safety Other	ER4_O	1,000s of LCU	Environmental and Regulatory 4—Dam and Public Safety Other

Fees Land Contracts	LW1_C	1,000s of LCU	Land and Water Fees 1—Land Rentals/Fees Contracts
Fees Land Labor	LW1_L	1,000s of LCU	Land and Water Fees 1—Land Rentals/Fees Labor
Fees Land Other	LW1_O	1,000s of LCU	Land and Water Fees 1—Land Rentals/Fees Other
Fees Water Contracts	LW2_C	1,000s of LCU	Land and Water Fees 2—Water Rentals/Fees Contracts
FeesWaterLabor	LW2_L	1,000s of LCU	Land and Water Fees 2—Water Rentals/Fees Labor
Fees Water Other	LW2_O	1,000s of LCU	Land and Water Fees 2—Water Rentals/Fees Other
Fixed Asset	FAV	1,000s of LCU	Fixed asset value (undepreciated)
Invest Dam Contracts	I1DRG_C	1,000s of LCU	Investment 1—major expense—nonrecurring dam/reservoir/general contracts
Invest Dam Labor	I1DRG_L	1,000s of LCU	Investment 1—Major expense—Nonrecurring dam/reservoir/general labor
Invest Dam Other	I1DRG_O	1,000s of LCU	Investment 1—Major expense—Nonrecurring dam/reservoir/general other
Invest Environ Contracts	I1EREG_C	1,000s of LCU	Investment 1—Major expense—Nonrecurring environmental and regulatory contracts
Invest Environ Labor	I1EREG_L	1,000s of LCU	Investment 1—Major Expense—Nonrecurring environmental and regulatory and labor
Invest Environ Other	I1EREG_O	1,000s of LCU	Investment 1—Major Expense—Nonrecurring environmental and regulatory other
Invest Powerhouse Contracts	I1PWR_C	1,000s of LCU	Investment 1—Major expense—Nonrecurring powerhouse contracts
InvestPowerhouseLabor	I1PWR_L	1,000s of LCU	Investment 1—Major expense—Nonrecurring powerhouse labor
Invest Powerhouse Other	I1PWR_O	1,000s of LCU	Investment 1—Major expense—Nonrecurring powerhouse other
Maint Non-Powerhouse Contracts	M2_C	1,000s of LCU	Maintenance 2—Nonpowerhouse maintenance expense Contracts

Maint Non-PowerhouseLabor	M2_L	1,000s of LCU	Maintenance 2—Nonpowerhouse maintenance expense labor
Maint Non-Powerhouse Other	M2_O	1,000s of LCU	Maintenance 2—Nonpowerhouse maintenance expense other
Maint Powerhouse Contracts	M1_C	1,000s of LCU	Maintenance 1—Powerhouse maintenance expense contracts
Maint Powerhouse Labor	M1_L	1,000s of LCU	Maintenance 1—Powerhouse maintenance expense labor
Maint Powerhouse Other	M1_O	1,000s of LCU	Maintenance 1—Powerhouse maintenance expense other
New Capital Dam Contracts	I3DRG_C	1,000s of LCU	Investment 3—Capital dam/reservoir/general contracts
New Capital Dam Labor	I3DRG_L	1,000s of LCU	Investment 3—Capital dam/reservoir/general labor
New Capital Dam Other	I3DRG_O	1,000s of LCU	Investment 3—Capital dam/reservoir/general other
NewCapitalEnvironContracts	I3EREG_C	1,000s of LCU	Investment 3—Capital environmental and regulatory contracts
New Capital Environ Labor	I3EREG_L	1,000s of LCU	Investment 3—Capital environmental and regulatory labor
New Capital Environ Other	I3EREG_O	1,000s of LCU	Investment 3—Capital environmental and regulatory other
New Capital Powerhouse Contracts	I3PWR_C	1,000s of LCU	Investment 3—Capital powerhouse contracts
New Capital Powerhouse Labor	I3PWR_L	1,000s of LCU	Investment 3—Capital powerhouse labor
New Capital Powerhouse Other	I3PWR_O	1,000s of LCU	Investment 3—Capital powerhouse other
Ops Facilities Contracts	O1_C	1,000s of LCU	Operations 1 facilities operations contracts
Ops Facilities Labor	O1_L	1,000s of LCU	Operations 1 facilities operations labor
Ops Facilities Other	O1_O	1,000s of LCU	Operations 1 facilities operations other
Ops Generation Contracts	O2_C	1,000s of LCU	Operations 2—Generation planning and integration contracts
Ops Generation Labor	O2_L	1,000s of LCU	Operations 2—Generation planning and integration labor

Ops Generation Other	O2_O	1,000s of LCU	Operations 2—Generation planning and integration other
OpsMiscContracts	O3_C	1,000s of LCU	Operations 3—miscellaneous contracts
Ops Misc Labor	O3_L	1,000s of LCU	Operations 3—miscellaneous labor
Ops Misc Other	O3_O	1,000s of LCU	Operations 3—miscellaneous other
Water Spilled	SPILL	1000 acre-ft	Water spilled
Exciter Current Rating	EXI	A	Rating of the exciter
Generator Current Rating	GENI	A	Rating of the generator
FullCapacity	Full_Cap	cfs	Full capacity
Operating Head	Oper_Head	ft	Plant design head
Head	TURB_HEAD	ft	Turbine rated head
Event End Time	EventETime	hh:mm	Hour and minute event ends
Event Start Time	EventSTime	hh:mm	Hour and minute event starts 24:00 clock
CondensingHours	CH	Hours	Condensing hours
Condensing Hours	UCH	Hours	Condensing hours unit level
ForcedOutageHours	FOH	Hours	Forced outage hours
Forced Outage Hours	UFOH	Hours	Total forced outage hours unit level
MaintenanceOutageHours	MOH	Hours	Maintenance outage hours
Maintenance Outage Hours	UMOH	Hours	Total maintenance outage hours unit level
OMC FOH	OMC_FOH	Hours	OMC FOH
OMCMOH	OMC_MOH	Hours	OMC MOH
OMC POH	OMC_POH	Hours	OMC POH
Period Hours	PH	Hours	Period hours
Period Hours	UPH	Hours	Period hours unit level
PlannedOutageHours	POH	Hours	Planned outage hours
Planned Outage Hours	UPOH	Hours	Total planned outage hours unit level
PumpingHours	PuH	Hours	Pumping hours
Pumping Hours	UPuH	Hours	Pumping hours unit level

ReserveShutdownHours	RSH	Hours	Reserve shutdown hours
Reserve Shutdown Hours	URSH	Hours	Reserve shutdown hours unit level
Service Hours	SH	Hours	Service hours
Service Hours	USH	Hours	Service hours unit level
Total Available Hours	TAH	Hours	Sum of service, reserve shutdown, pumping, and condensing
Total Unavailable Hours	TUH	Hours	Sum of planned, forced, and maintenance outage hours
Turbine Rated Capacity	TURB_CAP	hp	Rating of the turbine
hydroAMP Record Number	HP_NUM	Integer	Asset number in hydroAMP, started from 1, will keep increasing
Circuit Breaker Current Rating	CBI	kA	Rating of the circuit breaker
Interrupt Rating	CB_INT	kA	Circuit breaker interrupt rating
Circuit Breaker Voltage Rating	CBV	kV	Rating of the circuit breaker
Diameter	TURB_D	m	Turbine diameter
Event End Date	EventEDate	mm/dd/yyyy	Month, day, and year event ends
Event Start Date	EventSDate	mm/dd/yyyy	Month, day, and year event starts
Last Assessment Date	FRESH	mm/dd/yyyy	Date of the most recent Tier 1 score available for the component
Tier2 Assessment Date	T2_DATE	mm/dd/yyyy	Date of the Tier 2 assessment
Generator Stator Rated Capacity	GEN_CAP	MVA	Rating of the generator stator
Control MW	Cont_MW	MW	MW per control room
Gross Dependable Capacity	UGDC	MW	Hard capacity unit level
Gross Max Capacity	UGMC	MW	Max generating capacity unit level
Gross Capacity	Gross_ MW	MW	Gross capacity
Net Dependable Capacity	UNDC	MW	2% difference between gross and net values unit level
Net Max Capacity	UNMC	MW	2% difference between gross and net values unit level
Net Capacity	Net_MW	MW	Net capacity
Unit capacity	UNITCAP	MW	Capacity of installed unit
GrossActualGeneration	GAG	MWh	Gross actual generation

Gross Actual Generation	UGAG	MWh	Gross actual generation
NetActualGeneration	NAG	MWh	Net actual generation
Net Actual Generation	UNAG	MWh	Net actual generation
Power Factor	PF	N/A	Ratio of real power to apparent power
Station Index	SI	N/A	Score from 0 to 10 of plant health taken as an average of unit index ratings
Speed	TURB_SPEED	rpm	Turbine synchronous speed
Approved By	APPR	String	Managerial approver’s name
Battery Type	BATT_	String	Vented Lead Acid (VLA) or Valve Regulated Lead Acid (VRLA)
Crane Type	CRANE	String	Overhead, gantry, monorail hoist
DamType	Dam_Type	String	Dam type: arch, buttress, concrete, earthen, rock-filled, gravity, multi-arch, roller-compacted-concrete, masonry, timber crib, other
Emergency Closure Gate Types	ECG	String	Roller mounted, ring seal, wheel mounted, cylinder, fixed wheel, coaster, ring follower
Emergency Closure Valve Types	EGV	String	Butterfly, spherical, cone
Equipment Name	EQUIP	String	Turbine, transformer, crane, etc.
Evaluated By	EVAL	String	Evaluator's name
Excitation System Types	ES	String	Digital, analog, mechanical
Excitation System Types	EXC_TYPE	String	Analog, digital or mechanical systems
Generator Manufacturer	GEN_MANUF	String	Generator manufacturer
Generator Manufacturer Group	GEN_MG	String	Generator manufacturer group name
Governor Types	GOV	String	Digital, analog, mechanical
Insulation	SWI	String	Insulation material of the stator winding
OperatingPurpose	Purp	String	Operating purpose: environmental, flood control, generation, irrigation, navigation, other

Outage/Derating Event Type	EventType	String	Planned, forced (U1, U2, U3), maintenance, derates (PD, FD, D1, D2, D3), startup failure, outage extensions
Owner name	OWN_NAME	String	Plant owner name
Plant name	PLT_NAME	String	Name of plant
ProductionMode	Prod_mode	String	Production mode: base load, intermediate, peaking, other
Rehabilitation Contractor	CONT_REHAB	String	If rehab work is performed on the component, name of contractor
Surge Arrestor Type	SA	String	Silicon carbide, metal oxide, varistor
Tap Changer	TTP	String	Transformer tap changer
Tier 1 Comments	T1_COM	String	Evaluator's comments
Tier 2 Comments	T2_COM	String	Evaluator's comments
Turbine Manufacturer Group	T_MG	String	Turbine manufacturer group name
Turbine Type	TUR_TYPE	String	Turbine drive type: Francis, Kaplan, Pelton, Propeller
TurbineType	Turbine_Type	String	Predominate turbine runner type
Unit Manufacturer	MANUF	String	Turbine manufacturer
Unit Name	UNITNAME	String	Name of units
Utility Name	UTIL	String	Name of ownership company
Crane Rated Capacity	CRANE_tons	Tons	Rating of the crane
Gate Height	GATE_H	Unknown	Dimensions of the gate
Gate Weight	GATE_Weight	Unknown	Dimensions of the gate
Gate Width	GATE_W	Unknown	Dimensions of the gate
Pressure	GATE_P	Unknown	Not a single component has input a pressure value
Exciter Voltage Rating	EXV	V	Rating of the exciter
Generator Voltage Rating	GENV	V	Rating of the generator
DO Enhancement	DO_Enhn	Y/N	Dissolved oxygen (DO) enhancement
Fish Habitat	Fish_Hab	Y/N	Fish habitat improvement
Flood Control	Fld_Cont	Y/N	Flood control

Flow Restrictions	Flow_Rest	Y/N	Flow restrictions
Oil Containment	Oil_Cont	Y/N	Oil containment
Plant Project	Plant_Prj	Y/N	Plant project, run of river(Y) vs. storage(N): MOP is more descriptive
Powerhouse	Pwr_ House	Y/N	Enclosed powerhouse
Recreational Constraints	Recre_Const	Y/N	Recreational constraints
Spare Y/N	SPARE	Y/N	Is this component an onsite spare
Temperature Restrictions	Temp_Rest	Y/N	Temperature restrictions
Max Commercial OpYear	Max_Com_Op_Yr	year	Date of commercial operation
In Service Year	CISY	yyyy	Component specific in service year
Active Units	Actv_U		Active units
Actual Unit Starts	AcUS		Count of actual unit starts
Adjusted Weighted Score	ADJTIER1		Revised Tier 1 score accounting for Tier 2 adjustment
AGCUnits	AGC_U		Automatic generation control **units**
Asset Count	ASSET_COUNT		Number of assets reported per unit
Attempted Unit Starts	AtUS		Count of unit starts attempted
Cause Code	Cause_Code		NERC designated cause code
CI 1	HCI1		Condition indicator 1 age
CI 2	HCI2		Condition indicator 2 physical condition
CI 3	HCI3		Condition indicator 3 operations
CI 4	HCI4		Condition indicator 4 maintenance
CI 5	HCI5		Condition indicator 5 other
Condense Units	Cond_U		Condense units
Control Plants	Cont_Plants		No. of plants per control room
Control Staff	Cont_Staff		Unstaffed or staffed control room
Control Units	Cont_Units		No. of units per control room
Data Quality Indicator	DQI		Score representing how recently the component score has been updated
hydroAMP Plant Code	HP_CODE		Hydroamp specific plant code

Impulse Level	ECV_IMP	Emergency closure valve impulse level
Number of Cells	BATT_CELLS	Number of cells in battery
Number of Phases	PHASES	Exciter number of phases
Number of Poles	POLES	Number of rotor poles
Number of Windings	SW_TURNS	Number of stator winding turns
NumberUnits	#_U	Number units
Operator	OPS	Gate closure operator
PlantType	Pl_type	Plant type
RegionCode	Reg_Code	Region code from EUCG
RemoteUnits	Rmt_U	Remote units
River	River	River
State	State	State
Status	Status	Status
Tier 1 Score	TIER1	Score from 0 to 10 of unit health taken as a weighted average of condition index (CI)
Tier2 Adjustment	TIER2ADJ	Tier 2 scores adjust the Tier 1 scores up or down
Unit Number	U_NUM	Placement within powerhouse
Weighting Factor 1	HWF1	Weighting factor 1 age
Weighting Factor 2	HWF2	Weighting factor 2 physical condition
Weighting Factor 3	HWF3	Weighting factor 3 operations
Weighting Factor 4	HWF4	Weighting factor 4 maintenance
Weighting Factor 5	HWF5	Weighting factor 5 other

3. GEOSPATIAL HYDROLOGIC

HSDM: HS_DG: Summary of geospatial hydrologic data components

Data_Component	Alias	Type	Description
HS_m_ResFlowline	NHDPlus V1 Common Identifier	ID	NHDPlus V1 flowline common identifier.
HS_HUC_8	HydroSource HUC-8 Geospatial Polygon	Geospatial polyline layer	HydroSource HUC-8 geospatial polygon
HS_HUC_6	HydroSource HUC-6 Geospatial Polygon	Geospatial polyline layer	HydroSource HUC-6 geospatial polygon
HS_HUC_2	HydroSource HUC-2 Geospatial Polygon	Geospatial polyline layer	HydroSource HUC-2 geospatial polygon
HS_EF_RelationalTbl	HydroSource Relational Table	Geospatial polyline layer	HydroSource relational table between the HS_EF_Plant and HS_EF_Reservoir layers

HS_m_ResFlowline: Attribute summary

	Field Name	Alias	Unit	Description
1	COMID	NHDPlus V1 Common Identifier	ID	NHDPlus V1 flowline common identifier

HS_HUC_8: Attribute summary

	Field Name	Alias	Unit	Description
1	HUC_8	8-Digit HUC	ID	Eight-digit USGS HUC

HS_HUC_6: Attribute summary

Field Name	Alias	Unit	Description
HUC_6	6-Digit HUC	ID	Six-digit USGS HUC

HS_HUC_2: Attribute summary

Field Name	Alias	Unit	Description
HUC_2	2-Digit HUC	ID	Two-digit USGS HUC

HS_EF_RelationalTbl: Attribute summary

Field Name	Alias	Unit	Description
EF__RID	Existing Fleet Relational ID	ID	Unique identification code enabling a many-to-many relationship between the HS_EF_Plant and HS_EF_Reservoir layers
EF__PtID	Existing Fleet Plant ID	ID	Unique identification code assigned to each HS_EF_Plant record
EF_RsID	Existing Fleet Reservoir ID	ID	Unique identification code assigned to each HS_EF_Reservoir record

4. HYDROPOWER MARKET REPORT

Summary of Hydropower Market Report (HMR) Data Components

Data_Component	Alias	Type	Description
HS_MonthlyGen	Monthly Hydropower Generation	Time series	Monthly hydropower generation of preoperational, operational, and retired hydropower plants in the United States
HS_RefurbUpgrade	Refurbishments and Upgrades	Nonspatial table	Data integrated from the IIR database on refurbishment and upgrade (R&U) investment projects
HS_MWChange	Existing Fleet Annual Capacity Changes	Time series	Annual hydropower plant capacity changes from the EIA form 860
HS_PPA	Power Purchase Agreements	Nonspatial table	Data integrated from FERC's Form 1 data on power purchase transactions between electric utilities and hydropower plant owners

HS_MonthlyGen: Attribute summary

Alias	Field Name	Unit	Description
HS_MonthlyGen ID	MoGenID	ID	Unique identification code assigned to each HS_MonthlyGen record
Existing Fleet Plant ID	EF_PtID	ID	Unique identification code assigned to each HS_EF_Plant record
EIA Plant ID	EIA_PtID	ID	Plant-level ID for data from the EIA
Generation Year and Month	Date	yyyymm	Year and month that hydropower generation and consumption reported by the EIA occurred
Plant Name	Pt_Nm	N/A	Plant name
Hydropower Net Generation	HYNetGen	MWh	Monthly net hydropower generation of a hydropower plant

Pumped Storage Net Generation	PSNetGen	MWh	Monthly net pumped storage generation of a hydropower plant
Pumped Storage Consumption	PSConsum	MWh	Monthly pumped storage consumption of a hydropower plant
Pumped Storage Gross Generation	PSGross	MWh	Monthly gross pumped storage generation of a hydropower plant

HS_RefurbUpgrade: Attribute summary

Alias	Field Name	Unit	Description
Plant Refurb and Upgrade ID	Pt_RUID	ID	Unique identification code assigned to each HS_RefurbUpgrade record
Existing Fleet Plant ID	EF_PtID	ID	Unique identification code assigned to each HS_EF_Plant record
IIR Plant ID	IIR_PtID	ID	Unique identification code assigned to each plant-level record within the IIR Database
Project name	PRJ_NAME	N/A	R&U project name
Owner name	OWN_NAME	N/A	Plant owner name
Plant name	PLT_NAME	N/A	Name of plant undergoing R&U
Plant state	PLT_STATE	N/A	Plant location (state)
Unit name	UNITNAME	N/A	Name of units undergoing R&U
Project type	PRJ_TYPE	N/A	R&U project type
Project kickoff	PRJ_KOFF	N/A	R&U project kickoff year
Project status	PRJ_STAT	N/A	R&U project status
Project total investment value	PRJ_TIV	Million (2017$)	Project total investment value
Project scope	SCOPE	N/A	R&U detailed project description
Turbine work	TURBINE	N/A	1 if the project scope involves turbine modifications; 0 otherwise
Generator work	GNRATOR	N/A	1 if the project scope involves generator modifications; 0 otherwise

HS_MWChange: Attribute summary

Alias	Field Name	Unit	Description
HS_MWChange ID	MWChngID	ID	Annual hydropower plant capacity changes from EIA form 860
Existing Fleet Plant ID	EF_PtID	ID	Unique identification code assigned to each HS_EF_Plant record
EIA Plant ID	EIA_PtID	ID	Plant-level ID for data from the EIA
EIA Form 860 Year	EIA_Year	N/A	Year in which the capacity change was reported in EIA Form 860
HMR Region	HMR_Regn	N/A	Region where plant is located
Change in Plant Capacity	MWChange	MW	Change in plant capacity
Capacity Change Category	Category	N/A	Capacity change category: Capacity addition, downrate, retirement

HS_PPA: Attribute summary

Alias	Field Name	Unit	Description
Power Purchase Agreement ID	PPA_ID	ID	Unique identification code assigned to each HS_PPA record
Existing Fleet Plant ID	EF_PtID	ID	Unique identification code assigned to each HS_EF_Plant record
Year	Year	N/A	Year of transaction
HMR Region	HMR_Regn	N/A	Region where plant is located
Median Energy Price	MedianP	2016$/MWh	Median energy price paid by utilities for purchased electricity from hydropower plants
10th Percentile Energy price	10thPrcP	2016$/MWh	10th percentile from distribution of energy prices paid by utilities for purchased electricity from hydropower plants
90th Percentile Energy price	90thPrcP	2016$/MWh	90th percentile from distribution of energy prices paid by utilities for purchased electricity from hydropower plants
Average	AverageP	2016$/MWh	Average energy price paid by utilities for purchased electricity from hydropower plants
Number of observations	nobs	N/A	Number of hydropower purchase transactions reported by utilities to FERC Form 1

5. ENVIRONMENTAL

HSDM: HS_DG: Summary of environmental data components

Data_Component	Alias	Type	Description
HS_SiteClassAttributes	Site Classification Stream-Reach Attributes	Geospatial polyline layer	Attributes compiled from multiple layers geospatially referenced to NHDPlus v2 stream-reach data hosted within the Standard Modular Hydropower (SMH) Explorer, a geovisual analytics platform that empowers user-guided energy-water-environment-module data analysis and inquiries in support of ORNL's SMH research project.
HS_Mitigation	Non-Federal Hydropower Mitigation Database Version 1	Nonspatial table	Mitigation requirements and associated licensing information collated from FERC hydropower licenses issued from 1998 through 2013.
HS_E_StreamClass	Eastern Stream Classification	Geospatial polyline layer	The eastern stream classification (ESC) is a characterization of the biophysical settings of stream environments including hydrology, temperature, geomorphology, and disturbance regimes.
HS_EAFedListedFish	Environmental Attribution Federally Listed Fish Species by Sub-basin	Geospatial polygon layer	Maps of fish species listed under the Endangered Species Act (1973) or by the International Union for the Conservation of Nature (IUCN) per 8-digit HUC (HUC08) were created as part of the DOE/ORNL New Stream-Reach Development (NSD) Resource Assessment (http://nhaap.ornl.gov/nsd).
HS_EAFishTraits	Environmental Attribution US Fish-Traits by Sub-basin	Geospatial polygon layer	Maps of fish traits per HUC-8 created as apart of the DOE/ORNL NSD Resource Assessment (http://nhaap.ornl.gov/nsd).
HS_EAHydroClass	Environmental Attribution US Hydrologic Classification by Sub-basin	Geospatial polygon layer	Maps of hydrologic classes per HUC-8 were created as apart of the DOE/ORNL NSD Resource Assessment (http://nhaap.ornl.gov/nsd).
HS_EAWaterUse	US Water Use Distribution by Sub-basin	Geospatial polygon layer	Maps of estimated water use (2005), population density, housing density, precipitation, and potential evapotranspiration per HUC-8 created as apart of the DOE/ORNL NSD Resource Assessment (http://nhaap.ornl.gov/nsd).

HS_SiteClassAttributes: Attribute summary

Alias	Field Name	Unit	Description
SMH Site Class ID	SiteClassID	ID	Unique database identifier
	COMID	ID	Unique stream-reach identifier
	HUC_6	ID	6-digit HUC watershed
	gnis_name		Stream name
	streamorde		Strahler stream order
	minelevsmo	TBD	Elevation
	slope	TBD	Slope of stream reach
	qa_ma	cfs	Mean annual flow from runoff (cfs)
	va_ma	fps	Mean annual velocity for a flowline
	wsareasqkm	TBD	Total upstream drainage area
	rckdepcat	cm	Mean depth to bedrock in catchment (cm)
	pctclayws	%	Percent clay content of soils in watershed
	pctsandws	%	Percent sand content of soils in watershed
	wq10clstrs		Water quality clusters
	sed10clstr		Sediment clusters
	gen10clstr		Generation clusters
	npd_count		Number of non-powered dams (NPDs) in reach
	npd_mw		Total potential megawatts from NPDs in reach
	grp1		Number of ocean-run sturgeon species (Acipenseriformes) within the reach's HUC8 (count)
	grp2		Number of inland sturgeon/paddlefish species (Acipenseriformes) within the reach's HUC8 (count)
	grp3		Number of ocean-run clupeid species within the reach's HUC8 (count)
	grp4		Number of ocean-run eel/lamprey species within the reach's HUC8 (count)
	grp5		Number of ocean-run salmonid species within the reach's HUC8 (count)

grp6		Number of inland salmonid species within the reach's HUC8 (count)
grp7		Number of other inland migratory species within the reach's HUC8
fpsg10clst		Fish passage clusters
dist2sub		Distance to nearest substation from reach midpoint
state		State that reach lies in
supportrps		Percent of residents within county who support renewable energy portfolio standards
subregid		NERC Subregion ID
popchngsub		Projected population increase (in millions) by 2050 in NERC subregion
umct		Upstream mainstem dam count
unct		Total upstream dam count
dmct		Downstream mainstem dam count
tmct		Total mainstem dam count
um2d	TBD	Distance to upstream mainstem dam
dm2d	TBD	Distance to downstream mainstem dam
tm2d	TBD	Total mainstem distance between upstream and/or downstream mainstem dams
udor		Percentage of estimated annual discharge stored in upstream reservoirs
d303_temp		Stream listed as impaired for temperature on US Environmental Protection Agency (EPA) 303d list
d303_sdmnt		Stream listed as impaired for sediment on EPA 303d list
d303_ph		Stream listed as impaired for pH on EPA 303d list
d303_ntrnt		Stream listed as impaired for nutrients on EPA 303d list
d303_trbdt		Stream listed as impaired for turbidity on EPA 303d list
d303_do		Stream listed as impaired for DO on EPA 303d list
grndaccel	TBD	Earthquake susceptibility
pctagcat	%	Percent agricultural land cover in catchment
pctagws	%	Percent agricultural land cover in watershed

kffactcat		The Kffactor—relative index of susceptibility of bare, cultivated soil to particle detachment and transport by rainfall in catchment
kffactws		The Kffactor—relative index of susceptibility of bare, cultivated soil to particle detachment and transport by rainfall in watershed
ieofcat	TBD	Mean infiltration-excess overland flow in catchment
farmncat	TBD	Sum total of nitrogen from farm areas in catchment
pctforwetcat	%	Percent forest and wetland land cover in watershed
pctforwetws	%	Percent forest and wetland land cover in watershed
pctimprv06cat	%	Percent imperviousness from 2006 in catchment
pctimprv06ws	%	Percent imperviousness from 2006 in watershed
popdns10cat	TBD	Population density from 2010 census in catchment
pctforripws	%	Percent riparian forest land cover in watershed
runoffws	TBD	Mean runoff in watershed
qa_cv		Coefficient of variation for flow based on monthly averages and annual mean
elevdiffws	TBD	Difference between maximum and minimum elevation in watershed
bficat		Base-flow index in catchment
damundr	#/100 km	Upstream network dam density per unit stream network length (#/100 km)
damdmd	#/100 km	Downstream mainstem dam density per unit downstream mainstem length (#/100 km)
huc2prcntfp		Percent of mitigation sites in the mitigation database within the HUC2 that had Tier 1 fish passage mitigation required
fnd10clstrs		Foundation clusters
boat_ramp		Number of developed boat ramps in HUC6 (count)
boat_ramp_undeveloped		Number of undeveloped boat ramps in HUC6 (count)
fishing_coldwater		Number of cold water fishing locations in HUC6 (count)
fishing_saltwater		Saltwater fishing locations in HUC6 (count)
awhuc6km	m	Length of stream (m) identified as whitewater paddling runs in HUC6

nrirechuc6km	m	Length of stream (m) identified as having outstanding recreational value in HUC6
popdns10huc6	TBD	Mean population density in HUC6
rec10clstrs		Recreation clusters
nsd_count		Number of NSD sites in reach
nsd_mw	MW	Total potential megawatts from NSD sites in reach
genclusterdef		Short text description of generation clusters
wqclusterdef		Short text description of water quality clusters
sedclusterdef		Short text description of sediment clusters
fshclusterdef		Short text description of fish passage clusters
fndclusterdef		Short text description of foundation clusters
recclusterdef		Short text description of recreation clusters
st_length(shape)	m	Reach length in meters

HS_Mitigation: Attribute summary

Alias	Field Name	Unit	Description
Mitigation Database Record Identifier	RecordID	Number	Unique record identifier for each mitigation record entry in MITDB
Mitigation ID	MitigationID	String	Unique mitigation identifier code for each mitigation name
Existing Fleet Plant ID	EF_PtID	ID	Unique identification code assigned to each HS_EF_Plant record
Mitigation Name	Mitigation	String	Name of mitigation requirement
Tier Two Mitigation Classification	T2_Category	String	Second-tier classification of the mitigation requirement
Tier 2 Identifier Code	T2ID	String	Unique Tier 2 identifier code for each Tier 2 type
Tier One Mitigation Classification	T1_Category	String	Top tier classification of the mitigation requirement
Tier 1 Identifier Code	T1ID	String	Unique Tier 1 identifier code for each Tier 1 type
State	State	String	Hydropower plant state location
County	County	String	Hydropower plant county location

8-digit Hydrologic Unit Code	HUC08	String	Hydropower plant location by 8-digit HUC
2-digit Hydrologic Unit Code	HUC02	String	Hydropower plant location by 2-digit HUC
Water Body Name	Water	String	Water body associated with hydropower plant
FERC License Date	FcIssue	Date	Date FERC license was issued
FERC License Docket Number	FC_Dock	String	Identifier code for FERC license

HS_E_StreamClass: Attribute summary

Alias	Field Name	Unit	Description
	FID		Feature identifier
	COMID		NHDplus V1 segment identifier
	GNIS_NAME		Stream name
	FTYPE		Feature type (stream river, ArtificialPath)
	CUMDRAINAG		Cumulative drainage area (square kilometers)
	Size		Size class (headwater, creek, small river, medium river, mainstem, large river, great river)
	Gradient		Gradient class (very low, low-moderate, moderate, moderate-high, high, high-steep, steep, very steep)
	Confinement		Confinement class (confined, moderately unconfined, unconfined)
	Substrate		Substrate class (sand-fine gravel, coarse gravel, small cobble, large cobble, small boulder, large boulder-bedrock)
	Hydrology		Hydrologic class (IF-Intermittent Flashy, LTR—Late Timing Runoff, PR1-Perennial Runoff 1, PR2- Perennial Runoff 2, SSGW—Super Stable Groundwater, SHBF- Stable High Baseflow, SNM2- Snowmelt 2, UI—Unpredictable Intermittent, IF2—Intermittent Flashy 2)
	Temperature		Temperature class (cold, cold-cool, cool, cool-warm, warm)
	HUC		Hydrologic region (2-digit) (regions 1-6)
	mean_diam		Modeled mean substrate diameter (mm)
	TempC		Modeled average July-August temperature in degrees Celsius
	Slope		Slope of the stream reach (rise/run) from NHDPlus V1
	Flow		Mean annual discharge in cubic feet
	Length_km		Length of stream reach (kilometers)

WaterBody	Binary indication of whether stream reach intersects reservoir or lake
NHD_area	Binary indication of whether stream reach intersects an NHD area (typically impounded stretch of river)
Stor1	Cumulative upstream dam storage (acre feet)
DOR	Degree of regulation: (cubic feet storage by upstream dams/annual flow volume in cubic feet) × 100
Urban	% developed landcover in upstream network (NLCD 2006, includes codes 21, 22, 23, 24—%open space, %low intensity, %med intensity, %high intensity development)
Agr	% agriculture landcover in upstream network (NLCD 2006, includes codes 81 and 82—%Cropland and %Pasture)
Forest	% forested land cover in upstream network (NLCD 2006, includes codes 41, 42, and 43)
OceanFlag	Binary indication of whether stream reach is connected (free-flowing) to an estuary
GrtLkFlag	Binary indication of whether stream reach is connected (free-flowing) to a great lake
DCI_up	Dendritic connectivity index (from Cote et al. 2009—Landscape Ecology): Functional network/total upstream network× 100
NFHP	National Fish Habitat Partnership Fish Habitat Risk Score (from Esselmen et al. 2011—Ecological Indicators)
Fish	Binary indication of whether stream reach was previously surveyed (post-1990) for fish
Mussel	Binary indication of whether stream reach was previously surveyed (post-1990) for mussels
Crayfish	Binary indication of whether stream reach was previously surveyed (post-1990) for crayfish
Biota	Binary indication of whether stream reach was previously surveyed (post-1990) for any of the above biota
Simple	Simple stream classification typologies (excludes substrate)
Composite	Composite stream classification typologies (includes all classes)
Dist_Reach	Disturbance condition of each reach (not disturbed, impounded, landscape alteration, fragmented, regulated)
Hydrol_prb	Probability of hydrology class membership based on random forest model

HS_EAFedListedFish: Attribute summary

Alias	Field Name	Unit	Description
Federally Listed Fish ID		ID	Unique identification code assigned to each HS_EAFedListedFish record.
Hydrologic Region		N/A	Name for each 2-digit hydrologic unit
Hydrologic Subregion		N/A	Name for each 4-digit hydrologic unit
Hydrologic Basin		N/A	Name for each 6-digit hydrologic unit
Hydrologic Subbasin		N/A	Name for each 8-digit hydrologic unit
2-digit Hydrologic Unit Code		N/A	Identification Code for each 2-digit hydrologic unit
4-digit Hydrologic Unit Code		N/A	Identification Code for each 4-digit hydrologic unit
6-digit Hydrologic Unit Code		N/A	Identification Code for each 6-digit hydrologic unit
8-digit Hydrologic Unit Code		N/A	Identification Code for each 8-digit hydrologic unit
Acreage per 8-digit HUC		Acre	Acreage per 8-digit hydrologic unit
Square miles per 8-digit HUC		Square miles	Square miles per 8-digit hydrologic unit
8-digit HUC State		N/A	Dominant representative state per 8-digit hydrologic unit
Total fish species		N/A	The total number of fish species potentially occurring within each 8-HUC watershed. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset.
Number of endangered fish species under ESA		N/A	The number of fish species listed as “Endangered” under the Endangered Species Act (ESA) (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries.

		(http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of threatened fish species under ESA	N/A	The number of fish species listed as "Threatened" under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of candidate fish species under ESA	N/A	The number of fish species listed as "Candidate" species under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of fish species of concern under ESA	N/A	The number of fish species listed as "Species of Concern" under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of proposed endangered fish species under ESA	N/A	The number of fish species proposed as "Endangered" under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of proposed threatened fish species under ESA	N/A	The number of fish species proposed as "Threatened" under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of fish species with populations as	N/A	The number of fish species with a population (not entire species) listed as "Endangered" under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within

endangered under ESA		8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of fish species with populations as threatened under ESA	N/A	The number of fish species with a population (not entire species) listed as "Threatened" under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of fish species with populations as candidates under ESA	N/A	The number of fish species with a population (not entire species) proposed as a "Candidate" species under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of endangered or threatened fish species under ESA	N/A	The number of fish species listed as "Endangered" or "Threatened" under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of fish species falling under ESA designation	N/A	The total number of fish species (or their populations) recognized as listed, proposed, or candidate under the ESA (1973). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on listed status was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/).
Number of IUCN critically endangered fish species	N/A	The number of fish species ranked as "Critically Endangered" under the criteria developed by IUCN. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on IUCN criteria was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/). Descriptions of IUCN criteria are available from IUCN (International Union for the Conservation of Nature

		2001), IUCN Red List categories and criteria: Version 3.1, IUCN Species Survival Commission, IUCN, Gland, Switzerland, and Cambridge, UK.
Number of IUCN endangered fish species	N/A	The number of fish species ranked as "Endangered" under the criteria developed by the IUCN. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on IUCN criteria was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/). Descriptions of IUCN criteria are available from IUCN (International Union for the Conservation of Nature 2001), IUCN Red List categories and criteria: Version 3.1, IUCN Species Survival Commission, IUCN, Gland, Switzerland, and Cambridge, UK.
Number of IUCN vulnerable fish species	N/A	The number of fish species ranked as "Vulnerable" under the criteria developed by the IUCN. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on IUCN criteria was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/). Descriptions of IUCN criteria are available from IUCN (International Union for the Conservation of Nature 2001), IUCN Red List categories and criteria: Version 3.1, IUCN Species Survival Commission, IUCN, Gland, Switzerland, and Cambridge, UK.
Number of IUCN near threatened fish species	N/A	The number of fish species ranked as "Near Threatened" under the criteria developed by the IUCN. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on IUCN criteria was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/). Descriptions of IUCN criteria are available from IUCN (International Union for the Conservation of Nature 2001), IUCN Red List categories and criteria: Version 3.1, IUCN Species Survival Commission, IUCN, Gland, Switzerland, and Cambridge, UK.
Number of fish species under IUCN ranking	N/A	The number of fish species ranked as "Critically endangered," "Endangered," "Vulnerable," or "Near threatened" under the criteria developed by the IUCN. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on IUCN criteria was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/). Descriptions of IUCN criteria are available from IUCN (International Union for the Conservation of Nature 2001), IUCN Red List categories and criteria: Version 3.1, IUCN Species Survival Commission, IUCN, Gland, Switzerland, and Cambridge, UK.

All fish species of concern under ESA and IUCN	N/A	The number of fish species falling under the criteria of the ESA (1973) or ranking of the IUCN. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on ESA or IUCN criteria was obtained through Nature Serve Explorer (http://www.natureserve.org/explorer/). Descriptions of IUCN criteria are available from IUCN (International Union for the Conservation of Nature 2001), IUCN Red List categories and criteria: Version 3.1, IUCN Species Survival Commission, IUCN, Gland, Switzerland, and Cambridge, UK.

HS_EAFishTraits: Attribute summary

Alias	Field Name	Unit	Description
Fish Traits ID		ID	Unique identification code assigned to each HS_EAFishTraits record
Hydrologic Region		N/A	Name for each 2-digit hydrologic unit
Hydrologic Subregion		N/A	Name for each 4-digit hydrologic unit
Hydrologic Basin		N/A	Name for each 6-digit hydrologic unit
Hydrologic Subbasin		N/A	Name for each 8-digit hydrologic unit
2-digit Hydrologic Unit Code		N/A	Identification Code for each 2-digit hydrologic unit
4-digit Hydrologic Unit Code		N/A	Identification Code for each 4-digit hydrologic unit
6-digit Hydrologic Unit Code		N/A	Identification Code for each 6-digit hydrologic unit
8-digit Hydrologic Unit Code		N/A	Identification Code for each 8-digit hydrologic unit
Acreage per 8-digit HUC		Acre	Acreage per 8-digit hydrologic unit
Square miles per 8-digit HUC		Square miles	Square miles per 8-digit hydrologic unit
8-digit HUC State		N/A	Dominant representative state per 8-digit hydrologic unit
Total fish species		N/A	The total number of fish species potentially occurring within each 8-HUC Watershed. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were

		resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset.
Native fish species	N/A	The number of fish species native to North America potentially occurring within each 8-HUC Watershed. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Information on native species status for fishes was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Serial spawning fish species	N/A	The number of fish species documented as serial spawners within each 8-HUC Watershed. Serial spawning fish species (i.e., batch spawners) spawn multiple times per spawning season, as evidence of multiple clutches or separate distinct batches of eggs at various stages of maturation. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Lotic specialist/Serial spawning fish species	N/A	The number of fish species documented as serial spawners and preference for lotic habitats within each 8-HUC Watershed. Serial spawning fish species (i.e. batch spawners) spawn multiple times per spawning season, as evidence of multiple clutches or separate distinct batches of eggs at various stages of maturation. Lotic specialist fish prefer habitats with moving water. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Fish species with temporally restricted spawning seasons	N/A	The number of fish species with temporally restricted spawning seasons potentially occurring within each 8-HUC Watershed. Species with temporally restricted spawning seasons (i.e., high spawning seasonality) were identified by species falling within the

		lowest tenth percentile spawning season duration (number of months) for all species. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Lotic specialist/temporally restricted spawning fish species	N/A	The number of fish species with temporally restricted spawning seasons and preference for lotic habitats potentially occurring within each 8-HUC Watershed. Species with temporally restricted spawning seasons (i.e., high spawning seasonality) were identified by species falling within the lowest tenth percentile spawning season duration (number of months) for all species. Lotic specialist fish prefer habitats with moving water. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Habitat specialist fish species	N/A	The number of fish species considered habitat specialists potentially occurring within each 8-HUC Watershed. Habitat specialist scores were calculated by summing the number of habitats (substrates/waterbody types) and diet diversity characteristic of each species. Species with lower values were presumed to have more specific habitat needs. Habitat specialists were identified as those species having habitat specialist scores within the lowest tenth percentile of all species. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Lotic specialist/habitat specialist fish species	N/A	

Geographically limited fish species	N/A	The number of fish species with geographically limited ranges potentially occurring within each 8-HUC Watershed. Species with small ranges (in square kilometers) were identified as those with ranges falling within the lowest tenth percentile of all species. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Potadromous or anadromous fish species	N/A	The number of potadromous or anadromous fish species potentially occurring within each 8-HUC Watershed. Potadromous or anadromous were identified as exhibiting significant movement related to spawning between marine and freshwater or within freshwater. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Lotic fish species	N/A	The number of fish species preferring lotic habitats potentially occurring within each 8-HUC Watershed. Lotic specialist fish prefer habitats with moving water. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.

Lentic fish species	N/A	The number of fish species preferring lentic habitats potentially occurring within each 8-HUC Watershed. Lentic fish species prefer habitats without moving water. Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp) within 8-digit HUCs from the HUC250K version of watershed boundaries. (http://water.usgs.gov/GIS/huc.html). Fish species were resummarized into 8-digit HUC boundaries within the Watershed Boundary Dataset. Fish trait information was obtained through the Fish Traits database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A., and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.

HS_EAHydroClass: Attribute Summary

Alias	Field Name	Unit	Description
Hydrologic Classification ID		ID	Unique identification code assigned to each HS_EAHydroClass record
Hydrologic Region		N/A	Name for each 2-digit hydrologic unit
Hydrologic Subregion		N/A	Name for each 4-digit hydrologic unit
Hydrologic Basin		N/A	Name for each 6-digit hydrologic unit
Hydrologic Subbasin		N/A	Name for each 8-digit hydrologic unit
2-digit Hydrologic Unit Code		N/A	Identification Code for each 2-digit hydrologic unit
4-digit Hydrologic Unit Code		N/A	Identification Code for each 4-digit hydrologic unit
6-digit Hydrologic Unit Code		N/A	Identification Code for each 6-digit hydrologic unit
8-digit Hydrologic Unit Code		N/A	Identification Code for each 8-digit hydrologic unit
Acreage per 8-digit HUC		Acre	Acreage per 8-digit hydrologic unit
Square miles per 8-digit HUC		Square miles	Square miles per 8-digit hydrologic unit
8-digit HUC State		N/A	Dominant representative state per 8-digit hydrologic unit

Dominant Hydrologic Class Code	N/A	The dominant hydrologic class code represented within each 8-digit hydrologic unit. Hydrologic classes were created by McManamay et al. (2013) using discharge information from 2,618 USGS streamflow gages (USGS National Water Information System: http://waterdata.usgs.gov/usa/nwis/si). Hydrologic classes are groups of streams that share similar hydrologic properties, i.e., similarity in streamflow characteristics, and may respond similarly to impoundment. Theisen polygons were created for each USGS, and each dominant hydrologic class was assigned to 8-digit hydrologic unit. For descriptions of hydrologic classes, see metadata description. For more information see McManamay, R. A., M. S. Bevelhimer, and S. Kao, 2013, "A New US Hydrologic Classification: A Tool to Stratify Analyses in Ecohydrology," *Ecohydrology* (in review).
Secondary Hydrologic Class Code	N/A	The secondary hydrologic class code represented within each 8-digit hydrologic unit. Hydrologic classes were created by McManamay et al. (2013) using discharge information from 2,618 USGS streamflow gages (USGS National Water Information System: http://waterdata.usgs.gov/usa/nwis/si). Hydrologic classes are groups of streams that share similar hydrologic properties, i.e. similarity in streamflow characteristics, and may respond similarly to impoundment. Theisen polygons were created for each USGS, and each dominant hydrologic class was assigned to 8-digit hydrologic units. For descriptions of hydrologic classes, see metadata description. For more information see McManamay, R. A., M. S. Bevelhimer, and S. Kao, 2013, "A New US Hydrologic Classification: A Tool to Stratify Analyses in Ecohydrology," *Ecohydrology* (in review).
Dominant Hydrologic Class Name	N/A	The dominant hydrologic class name represented within each 8-digit hydrologic unit. Hydrologic classes were created by McManamay et al. (2013) using discharge information from 2,618 USGS streamflow gages (USGS National Water Information System: http://waterdata.usgs.gov/usa/nwis/si). Hydrologic classes are groups of streams that share similar hydrologic properties, i.e. similarity in streamflow characteristics, and may respond similarly to impoundment. Theisen polygons were created for each USGS, and each dominant hydrologic class was assigned to 8-digit hydrologic units. For descriptions of hydrologic classes, see metadata description. For more information see McManamay, R. A., M. S. Bevelhimer, and S. Kao, 2013, "A New US Hydrologic Classification: A Tool to Stratify Analyses in Ecohydrology," *Ecohydrology* (in review).
Secondary Hydrologic Class Name	N/A	The dominant hydrologic class name represented within each 8-digit hydrologic unit. Hydrologic classes were created by McManamay et al. (2013) using discharge information from 2,618 USGS streamflow gages (USGS National Water Information System: http://waterdata.usgs.gov/usa/nwis/si). Hydrologic classes are groups of streams that share similar hydrologic properties, i.e. similarity in streamflow characteristics, and may respond similarly to impoundment. Theisen polygons were created for each USGS, and each dominant hydrologic class was assigned to 8-digit hydrologic units. For descriptions of hydrologic classes, see metadata description. For more information see

		McManamay, R. A., M. S. Bevelhimer, and S. Kao, 2013, "A New US Hydrologic Classification: A Tool to Stratify Analyses in Ecohydrology," *Ecohydrology* (in review).
Number of hydrologic classes per HUC	N/A	The total number of hydrologic classes represented within each 8-digit hydrologic unit. Hydrologic classes were created by McManamay et al. (2013) using discharge information from 2,618 USGS streamflow gages (USGS National Water Information System: http://waterdata.usgs.gov/usa/nwis/si). Hydrologic classes are groups of streams that share similar hydrologic properties, i.e. similarity in streamflow characteristics, and may respond similarly to impoundment. Theisen polygons were created for each USGS, and each dominant hydrologic class was assigned to 8-digit hydrologic units. For descriptions of hydrologic classes, see metadata description. For more information see McManamay, R. A., M. S. Bevelhimer, and S. Kao, 2013, "A New US Hydrologic Classification: A Tool to Stratify Analyses in Ecohydrology," *Ecohydrology* (in review).

HS_EAWaterUse: Attribute summary

Alias	Field Name	Unit	Description
Water Use ID		ID	Unique identification code assigned to each HS_EAWaterUse record
Hydrologic Region		N/A	Name for each 2-digit hydrologic unit
Hydrologic Subregion		N/A	Name for each 4-digit hydrologic unit
Hydrologic Basin		N/A	Name for each 6-digit hydrologic unit
Hydrologic Subbasin		N/A	Name for each 8-digit hydrologic unit
2-digit Hydrologic Unit Code		N/A	Identification code for each 2-digit hydrologic unit
4-digit Hydrologic Unit Code		N/A	Identification code for each 4-digit hydrologic unit
6-digit Hydrologic Unit Code		N/A	Identification code for each 6-digit hydrologic unit
8-digit Hydrologic Unit Code		N/A	Identification code for each 8-digit hydrologic unit
Acreage per 8-digit HUC		Acre	Acreage per 8-digit hydrologic unit
Square miles per 8-digit HUC		Square miles	Square miles per 8-digit hydrologic unit
8-digit HUC State		N/A	Dominant representative state per 8-digit hydrologic unit

Population density	Individuals km^2	Average population density (individuals per km^2) within each 8-digit hydrologic unit. County level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Population density was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
House density	Houses km^2	Average housing density (houses per km^2) within each 8-digit hydrologic unit. County level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Housing density was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Precipitation	Inches	Average precipitation (inches) within each 8-digit hydrologic unit. Precipitation per 12-digit HUC was obtained from Wollock, D. (2003) Hydrologic landscape regions of the United States, US Geological Survey Open-File Report 03-145, Reston, VA: http://water.usgs.gov/GIS/metadata/usgswrd/XML/hlrus.xml. Precipitation was summarized by aggregating 12-digit hydrologic units into 8-digit hydrologic units.
Potential Evapotranspiration	Inches	Average potential evapotranspiration (inches) within each 8-digit hydrologic unit. PET per 12-digit HUC was obtained from Wollock, D. (2003) Hydrologic landscape regions of the United States, US Geological Survey Open-File Report 03-145, Reston, VA: http://water.usgs.gov/GIS/metadata/usgswrd/XML/hlrus.xml. Precipitation was summarized by aggregating 12-digit hydrologic units into 8-digit hydrologic units.
Aquaculture water use	L/day/1 km^2	Average aquaculture surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from USGS: Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Domestic water use	L/day/1 km^2	Average domestic surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files

		and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Total ground water use	L/day/1 km2	Average total ground water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Industrial water use	L/day/1 km2	Average industrial surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Irrigation water use	L/day/1 km2	Average irrigation surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Livestock water use	L/day/1 km2	Average livestock surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-

		data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Mining water use	L/day/1 km2	Average mining operations surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Public water use	L/day/1 km2	Average public surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Total surface water use	L/day/1 km2	Average total surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.
Thermoelectric water use	L/day/1 km2	Average thermoelectric surface water use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit

		hydrologic unit codes using area-weighted averages of county-level data.
Total freshwater use	L/day/1 km2	Average total freshwater (surface and groundwater) use (liters day-1 km-2) per 8-digit hydrologic unit. Water use estimates (2005) per county were obtained from Kenny, J. F., Barber, N. L., Hutson, S. S., Linsey, K. S., Lovelace, J. K., and Maupin, M. A., 2009, "Estimated use of water in the United States in 2005," *USGS Circular* 1344, 52 p. (http://pubs.usgs.gov/circ/1344/). County-level shape files and population density were obtained through the US Census Bureau (http://www.census.gov/geo/maps-data/data/tiger.html). Water use was summarized by 8-digit hydrologic unit codes using area-weighted averages of county-level data.

6. NON-POWERED DAMS

HSDM: HS_DG: Summary of NPD data components

Data_Component	Alias	Type	Description
HS_NPD_Dam	Non-Powered Dam	Geospatial point layer	Geospatial point locations of NPDs >1 MW
HS_NPD_Reservoir	Non-Powered Dam Reservoir	Geospatial polygon layer	Geospatial polygons of reservoirs impounded by NPDs >1 MW
HS_NPD_Tailwater	Non-Powered Dam Tailwater	Geospatial polyline layer	Geospatial polylines of tailwaters below each NPDs >1 MW

HS_NPD_Dam: Attribute summary

Alias	Field Name	Unit	Description
Non-Powerd Dam ID	NPD_DmID	ID	Unique identification code assigned to each HS_NPD_Dam record
NHDPlus V1 Common Identifier	COMID	ID	NHDPlus V1 common identifier of flow line
NID_ID1	NID_ID1	ID	Unique identification code assigned to each dam record within the NID Database
Latitude	Lat	DD	Latitude
Longitude	Lon	DD	Longitude
Dam Name	Dm_Nm	N/A	Name of the dam
Dam Owner Name	Dm_Own	N/A	Owner of the dam

County Name	CountyNm	N/A	County the dam is within
City Name	CityNm	N/A	City the dam is within
USPS 2-Letter Postal Code	Postal	N/A	Two-letter US Postal Service abbreviations of US states or associated territories that each NPD is within
Watersource	Water	N/A	Primary water source of the dam
Year Built	Yr_Built	YYYY	Year dam was built
Storage	Storage	ac-ft	NID Storage. A calculated field based on the maximum value of maximum storage and normal storage. Maximum storage, in acre-feet, which is defined as the total storage space in a reservoir below the maximum attainable water surface elevation, including any surcharge storage. Normal storage, in acre-feet, which is defined as the total storage space in a reservoir below the normal retention level, including dead and inactive storage and excluding any flood control or surcharge storage.
Federal Agency Regulatory Involvement	FedReg	N/A	Federal agency involvement in regulation. Code identifying which federal agency is involved in regulation of the dam. Codes are concatenated if several agencies are involved.
Estimated Head	esth	ft	Estimated head (ft) available for hydropower generation. Head is estimated from one of the following: (1) the NID hydraulic height, (2) 0.7 times the NID height, (3) US Army Corps of Engineers locks and dams lift, or (4) the height difference from observed head water and tailwater elevation. See *ORNL NPD Resource Assessment Report* for more details.
2-Digit HUC	HUC_2	ID	Watershed boundary dataset 2-digit hydrologic unit region code.
Annual Mean Flow	qyr	cfs	Annual mean flow (cfs). Flow is estimated from either the (1) NHDPlus annual mean flow or (2) drainage area times unit runoff estimated from historic National Water Information System (NWIS)streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
January Mean Flow	q01	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
February Mean Flow	q02	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
March Mean Flow	q03	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS

			streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
April Mean Flow	q04	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
May Mean Flow	q05	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
June Mean Flow	q06	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
July Mean Flow	q07	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
August Mean Flow	q08	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
September Mean Flow	q09	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
October Mean Flow	q10	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation, or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
November Mean Flow	q11	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
December Mean Flow	q12	cfs	Flow is estimated from either the (1) NHDPlus annual mean flow times ratios estimated from historic NWIS streamflow observation or (2) drainage area times unit runoff estimated from historic NWIS

			streamflow observation. See *ORNL NPD Resource Assessment Report* for details.
Potential Annual Hydropower Energy	MWh/year	MWh	Potential annual hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential January Hydropower Energy	mwh01	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential February Hydropower Energy	mwh02	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential March Hydropower Energy	mwh03	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential April Hydropower Energy	mwh04	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential May Hydropower Energy	mwh05	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential June Hydropower Energy	mwh06	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential July Hydropower Energy	mwh07	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential August Hydropower Energy	mwh08	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential September Hydropower Energy	mwh09	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential October Hydropower Energy	mwh10	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential November Hydropower Energy	mwh11	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.
Potential December Hydropower Energy	mwh12	MWh	Potential January hydropower energy (MWh), a product of estimated flow (cfs), head (ft), efficiency (0.85), time (hr), and 1/11800 for unit conversion.

Regional Capacity Factor	cf	%	Capacity factor of each power plant is computed by [annual generation in MWh/(installed capacity in MW × 365 × 24)]. The 2001–2008 EIA generation and capacity are used to estimate the capacity factor for each hydropower plant and then weight-averaged by plant generation to estimate the regional capacity factor. See *ORNL NPD Resource Assessment Report* for details.
Potential Capacity	mw	MW	Potential capacity (MW), estimated by [potential annual hydropower energy in MWh/(Cf × 365 × 24)].

HS_NPD_Reservoir: Attribute summary

Alias	Field Name	Unit	Description
Existing Fleet Reservoir ID	NPD_RsID	ID	Unique identification code assigned to each HS_EF_Reservoir record.
Existing Fleet Dam ID	NPD_DmID	ID	Unique identification code assigned to each HS_EF_Dam record.
NID ID	NID_ID1	ID	Unique identification code from the US Army Corps of Engineers National Inventory of Dams for each dam associated with the reservoir.
Dam Distance Kilometers	res_dam_di	100 km	Nearest distance from dam to edge of reservoir. If intersecting reservoir, then value is 0.
Area Square Kilometers	AreaSqKm	km2	Reservoir area in square kilometers
Reservoir Source	res_source	NA	Source of information used to create the reservoir (either NHDPlus “Waterbody” or NHDPlus V1 “Area”)
Latitude	lat	Decimal degrees	Latitude of dam
Longitude	lon	Decimal degrees	Longitude of dam
Coordinate From	cordfrom	NA	Source of information used for the longitude and latitude of the dam (either NHDPlus V1 or NID)
Georeferenced Dam	georef_dam	NA	Indication of whether the dam could be found and georeferenced (Yes or No)

HS_NPD_Tailwater: Attribute summary

Alias	Field Name	Unit	Description
NPD Tailwater ID	NPD_TlID	ID	Unique identification code assigned to each HS_NPD_Tailwater record
Non-Powerd Dam ID	NPD_DmID	ID	Unique identification code assigned to each HS_NPD_Dam record
NID ID	NID_ID	ID	Unique identification code from the US Army Corps of Engineers NID for each dam associated with the tailwater
	Water		
Latitude	Lat	Decimal degrees	Latitude of dam
Longitude	Lon	Decimal degrees	Longitude of dam
Length Km	LENGTHKM	Kilometers	Total length of each tailwater in kilometers
COMID Initial	COMIDini	ID	Unique identification code from NHDPlus V1 for each stream reach at the upstream end of the tailwater
COMID End	COMIDend	ID	Unique identification code from NHDPlus V1 for each stream reach at the downstream end of the tailwater
COMID	COMID	ID	Unique identification code from NHDPlus V1 for each stream reach at the location of the dam

7. NEW STREAM-REACH DEVELOPMENT

HSDM: HS_DG: Summary of NSD data components

Data_Component	Alias	Type	Description
HS_NSD_StreamReach	New Stream-Reach Development	Geospatial point layer	Geospatial point locations of NSD potential within stream reaches
HS_NSD_Inundation	New Stream-Reach Development Inundated Area	Geospatial polygon layer	Geospatial polygons of reservoirs impounded by locations of NSD stream reaches within the HydroSource Database
HS_NSD_Tailwater	New Stream-Reach Development Tailwater	Geospatial polyline layer	Geospatial polylines of tailwaters below each NSD stream reach within the HydroSource Database
HS_NSD_Environmental	NSD Environmental Attributes	Nonspatial table	Environmental attributes geospatially associated with the NSD inundated area, NSD stream reach, and NSD tailwater layers within the HydroSource Database

HS_NSD_StreamReach: Attribute summary

Alias	Field Name	Unit	Description
NSD Reach ID	ReachID	ID	The unique stream-reach identifier used in the NSD assessment. The last 4-digits of ReachID is the Subregion HUC04 ID.
10-Digit HUC	HUC_10	ID	Ten-digit HUC watershed identifier from the Watershed Boundary Dataset.
State Name	State	N/A	State name.
NHDPlus V1 Common Identifier	COMID	ID	NHDPlus V1 flow line common identifier.
	GNIS_NAME	N/A	The GNIS river name provided by the NHD.
NSD Dam Longitude	DamLon	DD	Longitude of the potential dam.
NSD Dam Latitude	DamLat	DD	Latitude of the potential dam.
NSD Dam Height	DamH_m	m	Potential dam height (or hydraulic head), estimated by reference height calculated from the Federal Emergency Management Agency (FEMA) 100-year flood elevation.
	DamH_ft	ft	Potential dam height (or hydraulic head), estimated by reference height calculated from the FEMA 100-year flood elevation.
Tailwater Elevation	Tail_m	m	Tailwater elevation.
Pool Water Elevation	Pool_m	m	Pool water elevation.
Reservoir Length	Length_m	m	The total reservoir length.
Average Channel Slope	Slope	m	Average channel slope (DamH_m/Length_m).
Annual Mean Flow	QNHD_cfs	cfs	The annual mean flow provided by NHDPlus (estimated by the unit runoff method).
Flow Adjustment Ratio	Q_ratio	N/A	Flow adjustment ratio used to estimate the NSD hydraulic capacity from NHDPlus version 1 flow (Q30 = Q_ratio × QNHD_cfs), derived from the USGS NWIS gauge observation.
Hydraulic Capacity	Q30_cfs	cfs	Hydraulic capacity, defined by the 30% exceedance quantile from the flow-duration curve, estimated by Q30 = Q_ratio × QNHD_cfs.
	HQS		The product of DamH_m, QNHD_cfs, and slope.
Generating Efficiency	eff	%	Generating efficiency, assumed to be 0.85 in this study.
Potential Hydropower Capacity	PNSD_MW	MW	Total potential capacity from identified stream reaches with capacity greater than 1 MW.
Annual Mean Flow	QYR_cfs	cfs	Annual mean flow estimated by the drainage area and USGS WaterWatch runoff

January Mean Flow	QJan_cfs	cfs	January mean flow estimated by the drainage area and USGS WaterWatch runoff.
February Mean Flow	QFeb_cfs	cfs	February mean flow estimated by the drainage area and USGS WaterWatch runoff.
March Mean Flow	QMar_cfs	cfs	March mean flow estimated by the drainage area and USGS WaterWatch runoff.
April Mean Flow	QApr_cfs	cfs	April mean flow estimated by the drainage area and USGS WaterWatch runoff.
May Mean Flow	QMay_cfs	cfs	May mean flow estimated by the drainage area and USGS WaterWatch runoff.
June Mean Flow	QJun_cfs	cfs	June mean flow estimated by the drainage area and USGS WaterWatch runoff.
July Mean Flow	QJul_cfs	cfs	July mean flow estimated by the drainage area and USGS WaterWatch runoff.
August Mean Flow	QAug_cfs	cfs	August mean flow estimated by the drainage area and USGS WaterWatch runoff.
September Mean Flow	QSep_cfs	cfs	September mean flow estimated by the drainage area and USGS WaterWatch runoff.
October Mean Flow	QOct_cfs	cfs	October mean flow estimated by the drainage area and USGS WaterWatch runoff.
November Mean Flow	QNov_cfs	cfs	November mean flow estimated by the drainage area and USGS WaterWatch runoff.
December Mean Flow	QDec_cfs	cfs	December mean flow estimated by the drainage area and USGS WaterWatch runoff.
Estimated Potential Annual Energy	ENSD_MWh	MWh	Estimated potential annual energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential January Energy	EJan_MWh	MWh	Estimated potential January energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential February Energy	EFeb_MWh	MWh	Estimated potential February energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential March Energy	EMar_MWh	MWh	Estimated potential March energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential April Energy	EApr_MWh	MWh	Estimated potential April energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential May Energy	EMay_MWh	MWh	Estimated potential May energy at stream reaches. See *NSD Methodology Report* for more details.

Estimated Potential June Energy	EJun_MWh	MWh	Estimated potential June energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential July Energy	EJul_MWh	MWh	Estimated potential July energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential August Energy	EAug_MWh	MWh	Estimated potential August energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential September Energy	ESep_MWh	MWh	Estimated potential September energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential October Energy	EOct_MWh	MWh	Estimated potential October energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential November Energy	ENov_MWh	MWh	Estimated potential November energy at stream reaches. See *NSD Methodology Report* for more details.
Estimated Potential December Energy	EDec_MWh	MWh	Estimated potential December energy at stream reaches. See *NSD Methodology Report* for more details.
Annual Capacity Factor	Cf_yr	%	Capacity factor, estimated by (potential annual energy in MWh)/(potential capacity in MW × 365 × 24).
Spring Capacity Factor	Cf_Sp	%	Capacity factor, estimated by (potential March-May energy in MWh)/(potential capacity in MW × (31+30+31) × 24).
Summer Capacity Factor	Cf_Su	%	Capacity factor, estimated by (potential June-August energy in MWh)/(potential capacity in MW × (30+31+31) × 24.
Fall Capacity Factor	Cf_Fa	%	Capacity factor, estimated by (potential September-November energy in MWh)/(potential capacity in MW × (30+31+30) × 24).
Winter Capacity Factor	Cf_Wi	%	Capacity factor, estimated by (potential December-February energy in MWh)/(potential capacity in MW × (31+31+28) × 24).
Number of Pipes in Diversion Scenario	Div_NPipe	Number	Number of pipes calculated in the diversion scenario. See *NSD Methodology Report* for more details.
Diameter of Pipes in Diversion Scenario	Div_D_ft	ft	Diameter of the pipes calculated in the diversion scenario. See *NSD Methodology Report* for more details.
Velocity of Pipes in Diversion Scenario	Div_V_fts	ft/s	Velocity in the pipes (ft/s) calculated in the diversion scenario. See *NSD Methodology Report* for more details.
Effective Head	Div_H_ft	ft	Effective head (after considering head loss) calculated in the diversion scenario. See *NSD Methodology Report* for more details.
Diversion Scenario Potential Capacity	Div_P_MW	MW	Potential capacity calculated in the diversion scenario. See *NSD Methodology Report* for more details.

HS_NSD_Inundation: Attribute summary

Alias	Field Name	Unit	Description
NSD Inundation ID	NSD_InID	ID	Unique identification code assigned to each HS_NSD_Inundation record.
NSD Reach ID	ReachID	ID	Unique stream-reach identifier used in the NSD assessment. The last 4-digits of ReachID is the Subregion HUC04 ID.
Estimated Surface Inundation	ANSD_ac	ac	Estimated surface inundation corresponding to the reference height, derived from the 10-meter resolution National Elevation Datase.
Estimated Reservoir Storage	VNSD_acft	ac-ft	Estimated reservoir storage corresponding to the reference height, derived from the 10 m resolution National Elevation Dataset.
Residence Time	TNSD_day		Residence time, estimated by d × (reservoir storage in ac×ft)/(NHDPlus annual mean flow in cfs). d = 0.504 is a unit conversion factor.
Critical Habitats	CRITHABi	Number	Number of critical habitats occurring within 800 m of potential inundated areas designated for potential hydropower development. Critical habitats are lines or polygons designated by the US Fish and Wildlife Service for federally listed species under the ESA of 1973.
	FISHESAi	Number	Number of federally listed fish species potentially occurring within the 8-HUC watershed containing each inundated area. Federally listed fish included species whose entire population or subpopulation is listed as "endangered," "threatened," proposed for listing, or a species of concern according to the ESA (1973) (http://www.fws.gov/endangered/species/us-species.html). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp). Federally listed species were obtained from the US Fish and Wildlife Service.
	FSHIUCNi	Number	Number of fish species of concern potentially occurring within the 8-HUC watershed containing each inundated area. Fish species of concern were determined according to the IUCN Red List Criteria (http://www.iucnredlist.org/technical-documents/categories-and-criteria). Fish species distributions were available from NatureServe at the 8-HUC watershed scale (http://www.natureserve.org/getData/fishMaps.jsp). IUCN rankings were obtained from NatureServe explorer (www.natureserve.org/explorer/).
	FISHPOTi	Number	Number of fish species documented as potadromous within the 8-HUC watershed containing each inundated area. Potadromous fish are species migrating entirely in freshwater to complete their life cycle requirements.
	PROTLNDi	Number	An indication of whether protected conservation lands occur within 2,500 m of potential inundated areas designated for potential hydropower development. "1" indicating "yes," and "0" indicating "no." Protected

			conservation lands were obtained from the Protected Area Database, developed by the USGS Gap Analysis Program.
	LOWNIDXi	Number	The Land Ownership Index is the sum of the number of different governmental or nongovernmental entity lands that occur within 2,500 m of potential inundated areas designated for potential hydropower development.
	LNDDESGi	Number	The Land Designation Index is the sum of the number of different land designations that occur within 2,500 m of potential inundated areas designated for potential hydropower development. Land designations include US National Park, US National Forest/Grassland, National Trail, National Wildlife Refuge, National Natural Landmark, National Landscape Conservation System (Non-Wilderness), National Landscape Conservation System (Wilderness), Wild and Scenic Rivers, Marine Protected Area, Wilderness Area, Historic/Cultural Area, Military Land, Habitat or Species Management Area, Research Natural Area, Local Conservation, Private Conservation, and Conservation Program Land. Thus, the Land Designation Index could range from 0 (no protected land intersecting a stream reach) to 17 (all designation types intersect a stream reach). Protected conservation lands were obtained from the Protected Area Database, developed by the USGS Gap Analysis Program.
	NATPRKi	Number	An indication of whether US National Parks occur within 2,500 m of potential inundated areas designated for potential hydropower development. “1” indicating “yes,” and “0” indicating “no.” US National Park lands were obtained from the Protected Area Database developed by the USGS Gap Analysis Program (http://gapanalysis.usgs.gov/data/padus-data/padus-data-download/).
	WSRi	Number	An indication of whether US designated Wild and Scenic Rivers occur within 2,500 m of potential inundated areas designated for potential hydropower development. “1” indicating “yes,” and “0” indicating “no.” Wild and Scenic River polylines were obtained from the National Wild and Scenic Rivers System website (http://www.rivers.gov/rivers/mapping-gis.php).
303d Listed Waterbodies	Wqi	Number	Number of 303d listed waterbodies occurring within 500 m of potential inundated areas designated for potential hydropower development. Under the Clean Water Act (1977), Section 303(d), states are required to specify designated uses for all waterways (e.g., public water supply, protection of fish and wildlife, recreation). In addition, each state must identify and adopt water quality criteria that support each designated use category and determine a list of streams that are not meeting their designated uses (303d List). 303d waterbody listings were obtained from the US EPA Impaired Waters and Total Maximum Daily Load website (http://www.epa.gov/waters/data/downloads.html).
Whitewater Boating Runs	AWRAFTi	Number	Number of whitewater boating runs (launch/take-out point combinations) occurring within 500 m of potential inundated areas designated for potential hydropower development. Locations of whitewater boating runs

			were obtained from the American Whitewater National Whitewater Inventory (http://www.americanwhitewater.org/content/River/view/).
Waterfalls	FALLSi	Number	Number of waterfalls occurring within 800 m of potential inundated areas designated for potential hydropower development. Locations of waterfalls were obtained from Geology.com (http://geology.com/waterfalls/).
Boat Ramps	BOATRMPi	Number	Average number of developed and undeveloped boat ramps intersecting 500 m buffered areas around potential inundated areas for development within each 10-HUC watershed. Locations of boat ramps were obtained from Delorme Publishing Company (http://www.delorme.com/).
	FISHACCi	Number	Average number of fishing access locations intersecting buffered areas around stream-reaches designated for potential development within each 10-HUC watershed. Boat ramp locations were obtained from Delorme Publishing Company (http://www.delorme.com/).
	S_WUSEi		Estimated surface water use [(L/d)/km^2] within the 8-HUC watershed containing each inundated area. Estimates of 2005 water use in the United States were obtained from the USGS Water Use Data site (http://water.usgs.gov/watuse/data/2005/index.html). Estimates per 8-HUC watersheds were based on area-weighted averages from county estimates.
	G_WUSEi		Estimated groundwater use [(L/d)/km^2] within the 8-HUC watershed containing each inundated area. Estimates of 2005 water use in the United States were obtained from the USGS Water Use Data site (http://water.usgs.gov/watuse/data/2005/index.html). Estimates per 8-HUC watersheds were based on area-weighted averages from county estimates.
Catchment Urbanizatio n	URBANi	%	Percentage of area composed of low-intensity, moderate-intensity, and high-intensity urbanization within each NHDPlus watershed containing each inundated area. Urban landcover based on National Land Cover Database 2001 (Multi-Resolution Land Characteristics Consortium [MRLC]: http://www.mrlc.gov /datasets). Urban land cover within each NHDPlus catchment was available from the National Fish Habitat Action Plan dataset (http://ecosystems.usgs.gov/fishhabitat/).
Catchment Population Density	POPDENi		Estimated population density (individuals/km^2) within each NHDPlus watershed containing each inundated area. Based on US Population Density 2000 data from the National Oceanic and Atmospheric Administration: http://www.ngdc.noaa.gov/dmsp/download_sprawl.html. Population density within each NHDPlus catchment was available from the National Fish Habitat Action Plan dataset (http://ecosystems.usgs.gov/fishhabitat/).
	L_DAMSi	Number	Number of dams occurring within each NHDPlus watershed containing each inundated area. Dam locations were based on the US Army Corps of Engineers National Dam Inventory (http://www.usace.army.mil/Library/Maps/Pages/NationalInventoryofDams.aspx). The number of dams per NHDPlus catchment was available

			from the National Fish Habitat Action Plan dataset (http://ecosystems.usgs.gov/fishhabitat/).
Number of Upstream Dams	N_DAMSi	Number	Number of dams occurring in the drainage network upstream of each NHDPlus watershed containing each inundated area. Dam locations based on the US Army Corps of Engineers National Dam Inventory (http://www.usace.army.mil/Library/Maps/Pages/NationalInventoryofDams.aspx). The number of dams occurring in the entire upstream network per each NHDPlus catchment was available from the National Fish Habitat Action Plan dataset (http://ecosystems.usgs.gov/fishhabitat/).
Inundated Area Land Disturbance Index	LD_IDXi	Number	The Land Disturbance Index for each NHDPlus watershed containing each inundated area. Land Disturbance Indices were created for NHDPlus catchments through the National Fish Habitat Action Plan (http://ecosystems.usgs.gov/fishhabitat/). A cumulative disturbance index was created for approximately 2.23 million US river reaches (NHD flow lines) from landscape anthropogenic activities using urban areas, agricultural areas, roads, dams, mines, population density, and point-source pollution sites. Lower values indicate higher disturbance to aquatic habitats.

HS_NSD_Tailwater: Attribute summary

Alias	Field Name	Unit	Description
NSD Tailwater ID	NSD_TlID	ID	Unique identification code assigned to each HS_NSD_Tailwater record.
NSD Reach ID	ReachID	ID	Unique stream-reach identifier used in the NSD assessment. The last 4-digits of ReachID is the Subregion HUC04 ID.
10-Digit HUC	HUC_10	ID	Ten-digit HUC watershed identifier from the Watershed Boundary Dataset.
COMID Initial	COMIDini	ID	Unique identification code from NHDPlus V1 for each stream reach at the upstream end of the tailwater.
COMID End	COMIDend	ID	Unique identification code from NHDPlus V1 for each stream reach at the downstream end of the tailwater.
GNIS River Name	GNIS_NAME	ID	The GNIS river name provided by the NHD.
Tailwater Length	LENGTHKM	km	Tailwater length, defined by calculating the total length of all merged NHDPlus V1 flow lines comprising the tailwater.
Potential Dam Longitude	DamLon	DD	Longitude of the potential dam.

Potential Dam Latitude	DamLat	DD	Latitude of the potential dam.
Critical Habitat	CRITHABt	Number	Number of critical habitats occurring within 800 m of each tailwater. Critical habitats are lines or polygons designated by the US Fish and Wildlife Service for federally listed species under the ESA of 1973 (http://criticalhabitat.fws.gov/crithab/).
Federally Listed Fish Species	FISHESAt	Number	Number of federally listed fish species potentially occurring within the 8-HUC watershed containing each tailwater. Federally listed fish included species whose entire population or subpopulation is listed as "endangered," "threatened," proposed for listing, or a species of concern according to the ESA (1973) (http://www.fws.gov/endangered/species/us-species.html). Fish species distributions were available from NatureServe (http://www.natureserve.org/getData/fishMaps.jsp). Federally listed species were obtained from the US Fish and Wildlife Service.
Fish Species of Concern	FISHIUCNt	Number	Number of fish species of concern potentially occurring within the 8-HUC watershed containing each tailwater. Fish species of concern were determined according to the IUCN Red List Criteria (http://www.iucnredlist.org/technical-documents/categories-and-criteria). Fish species distributions were available from NatureServe at the 8-HUC watershed scale (http://www.natureserve.org/getData/fishMaps.jsp). IUCN rankings were obtained from NatureServe explorer (www.natureserve.org/explorer/).
Potadromous Fish Species	FISHPOTt	Number	Number of fish species documented as potadromous within the 8-HUC watershed containing each tailwater. Potadromous fish are species migrating entirely in freshwater to complete their life cycle requirements. Fish species distributions were available from NatureServe at the 8-HUC watershed scale (http://www.natureserve.org/getData/fishMaps.jsp). Information on potadromy for fishes was obtained through the Fish Traits Database (http://fishwild.vt.edu/fishtraits/). See also Frimpong, E. A. and P. L. Angermeier (2009), "Fish Traits: A database of Ecological and Life-history traits of freshwater fishes of the United States," *Fisheries* 34: 487–495.
Protected Lands	PROTLNDt	Number	An indication of whether protected conservation lands occur within 800 m of each tailwater. "1" indicating "yes," and "0" indicating "no." Protected conservation lands were obtained from the Protected Area Database, developed by the USGS Gap Analysis Program.
Land Ownership Index	LOWNIDXt	Number	The Land Ownership Index is the sum of the number of different governmental or nongovernmental entity lands that occur within 800 m of each tailwater. Entities include federal, state, nongovernmental agency, local government, Native American, regional agency, territorial, private conservation, joint ownership, and unknown agency. Thus, the Land Ownership Index could range from 0 (no protected land intersecting a stream reach) to 10 (all entities have lands intersecting a stream reach). Protected conservation lands were obtained from the Protected Area Database developed by the USGS Gap Analysis Program.

Land Designation Index	LNDDESGt	Number	The Land Designation Index is the sum of the number of different land designations that occur within 80 m of each tailwater. Land designations include US National Park, US National Forest/Grassland, National Trail, National Wildlife Refuge, National Natural Landmark, National Landscape Conservation System (Non-Wilderness), National Landscape Conservation System (Wilderness), Wild and Scenic Rivers, Marine Protected Area, Wilderness Area, Historic/Cultural Area, Military Land, Habitat or Species Management Area, Research Natural Area, Local Conservation, Private Conservation, and Conservation Program Land. Thus, the Land Designation Index could range from 0 (no protected land intersecting a stream reach) to 17 (all designation types intersect a stream reach). Protected conservation lands were obtained from the Protected Area Database developed by the USGS Gap Analysis Program (http://gapanalysis.usgs.gov/data/padus-data/padus-data-download/).
National Parks	NATPRKt	Number	An indication of whether US National Parks occur within 800 m of each tailwater. “1” indicating “yes,” and “0” indicating “no.” US National Park lands were obtained from the Protected Area Database developed by the USGS Gap Analysis Program (http://gapanalysis.usgs.gov/data/padus-data/padus-data-download/).
Wild and Scenic Rivers	WSRt	Number	An indication of whether US designated Wild and Scenic Rivers occur within 800 m of each tailwater. “1” indicating “yes,” and “0” indicating “no.” Wild and Scenic River polylines were obtained from the National Wild and Scenic Rivers System website (http://www.rivers.gov/rivers/mapping-gis.php).
303d Listed Waterbodies	WQt	Number	Number of 303d listed waterbodies occurring within 500 m of each tailwater. Under the Clean Water Act (1977), Section 303(d), states are required to specify designated uses for all waterways (e.g., public water supply, protection of fish and wildlife, recreation). In addition, each state must identify and adopt water quality criteria that support each designated use category and determine a list of streams that are not meeting their designated uses (303d List). 303d waterbody listings were obtained from the US EPA Impaired Waters and Total Maximum Daily Load website (http://www.epa.gov/waters/data/downloads.html).
Waterfalls	FALLSt	Number	Number of waterfalls occurring within 800 m of each tailwater. Locations of waterfalls were obtained from Geology.com (http://geology.com/waterfalls/).
Developed and Undeveloped Boat Ramps	BOATRMPt	Number	Number of developed and undeveloped boat ramps occurring within 500 m of each tailwater. Locations of boat ramps were obtained from Delorme Publishing Company (http://www.delorme.com/).
Fishing Access Locations	FISHACCt	Number	Number of fishing access locations occurring within 500 m of each tailwater. Boat ramp locations were obtained from Delorme Publishing Company (http://www.delorme.com/).
Estimated Surface Water Use	S_WUSEt		Estimated surface water use [(L/d)/km^2] within the 8-HUC watershed containing each tailwater. Estimates of 2005 water use in the United States were obtained from the USGS Water Use Data site (http://water.usgs.gov/watuse/data/2005/index.html). Estimates per 8-HUC watersheds were based on area-weighted averages from county estimates.

Estimated Ground Water Use	G_WUSEt		Estimated ground water use [(L/d)/km^2] within the 8-HUC watershed containing each tailwater. Estimates of 2005 water use in the United States were obtained from the Water Use Data site (http://water.usgs.gov/watuse/data/2005/index.html). Estimates per 8-HUC watersheds were based on area-weighted averages from county estimates.
Urbanization	URBANt	%	Percentage of area composed of low-intensity, moderate-intensity, and high-intensity urbanization within each NHDPlus watershed containing the upstream reach of each tailwater. Urban landcover based on the National Land Cover Database 2001 (MRLC): http://www.mrlc.gov /datasets. Urban land cover within each NHDPlus catchment was available from the National Fish Habitat Action Plan Dataset (http://ecosystems.usgs.gov/fishhabitat/).
Population Density	POPDENt		Estimated population density (individuals/km^2) within each NHDPlus watershed containing the upstream reach of each tailwater. Based on US Population Density 2000 data from the National Oceanic and Atmospheric Administration: http://www.ngdc.noaa.gov/dmsp/download_sprawl.html. Population density within each NHDPlus catchment was available from the National Fish Habitat Action Plan Dataset (http://ecosystems.usgs.gov/fishhabitat/).
Upstream Reach Dams Within Watershed	L_DAMSt	Number	Number of dams occurring within NHDPlus watershed containing the upstream reach of each tailwater. Dam locations were based on the US Army Corps of Engineers National Dam Inventory (http://www.usace.army.mil/Library/Maps/Pages/NationalInventoryofDams.aspx). The number of dams per NHDPlus catchment was available from the National Fish Habitat Action Plan Dataset (http://ecosystems.usgs.gov/fishhabitat/).
	N_DAMSt	Number	Number of dams occurring in the drainage network upstream of each NHDPlus watershed containing the upstream reach of each tailwater. Dam locations based on the US Army Corps of Engineers National Dam Inventory (http://www.usace.army.mil/Library/Maps/Pages/NationalInventoryofDams.aspx). The number of dams occurring in the entire upstream network per each NHDPlus catchment was available from the National Fish Habitat Action Plan Dataset (http://ecosystems.usgs.gov/fishhabitat/).
Land Disturbance Index	LD_IDXi	Number	The Land Disturbance Index for each NHDPlus watershed containing the upstream reach of each tailwater. Land disturbance indices were created for NHDPlus catchments through the National Fish Habitat Action Plan (http://ecosystems.usgs.gov/fishhabitat/). A cumulative disturbance index was created for approximately 2.23 million US river reaches (NHD flow lines) from landscape anthropogenic activities using urban areas, agricultural areas, roads, dams, mines, population density, and point-source pollution sites. Lower values indicate higher disturbance to aquatic habitats.

HS_NSD_Environmental: Attribute summary

Alias	Field Name	Unit	Description
NSD Environmental Attributes ID	NSD_EnvID	ID	Unique identification code assigned to each HS_NSD_Environmental record.
NSD Reach ID	ReachID	ID	Unique stream-reach identifier used in the NSD assessment. The last 4-digits of the ReachID are the Subregion HUC04 ID.
Critical Habitats	CRITHABd	Number	Number of critical habitats occurring within 8,000 m of the potential dam location designated for potential hydropower development. Critical habitats are lines or polygons designated by the US Fish and Wildlife Service for federally listed species under the ESA of 1973.
Federally Listed Fish Species	FISHESAd	Number	Number of federally listed fish species potentially occurring within the 8-HUC watershed containing each dam location. Federally listed fish included species whose entire population or subpopulation is listed as “endangered,” “threatened,” proposed for listing, or a species of concern according to the ESA (1973).
Potadromous Fish Species of Concern	FSHIUCNd	Number	Number of fish species of concern potentially occurring within the 8-HUC watershed containing each dam location. Fish species of concern were determined according to the IUCN Red List Criteria.
Potadromous Fish Species	FISHPOTd	Number	Number of fish species documented as potadromous within the 8-HUC watershed containing each dam location. Potadromous fish are species migrating entirely in freshwater to complete their life cycle requirements.
Conservation Lands Near Potential Dam	PROTLNDd	N/A	An indication of whether protected conservation lands occur within 2,500 m of potential dam locations designated for potential hydropower development. “1” indicating “yes,” and “0” indicating “no.”
Land Ownership Index	LOWNIDXd	Number	The Land Ownership Index is the sum of the number of different governmental or nongovernmental entity lands that occur within 2,500 m of potential dam locations designated for potential hydropower development. Entities include federal, state, nongovernmental agency, local government, Native American, regional agency, territorial, private conservation, joint ownership, and unknown agency. Thus, the Land Ownership Index could range from 0 (no protected land intersecting a stream reach) to 10 (all entities have lands intersecting a stream reach).
Land Designation Index	LNDDESGd	Number	The Land Designation Index is the sum of the number of different land designations that occur within 2,500 m of potential dam locations designated for potential hydropower development. Land designations include US National Park, US National Forest/Grassland, National Trail, National Wildlife Refuge, National Natural Landmark, National Landscape Conservation System (Non Wilderness), National Landscape Conservation

			System (Wilderness), Wild and Scenic Rivers, Marine Protected Area, Wilderness Area, Historic/Cultural Area, Military Land, Habitat or Species Management Area, Research Natural Area, Local Conservation, Private Conservation, and Conservation Program Land. Thus, the Land Designation Index could range from 0 (no protected land intersecting a stream reach) to 17 (all designation types intersect a stream reach).
National Parks Near Potential Dam	NATPRKd	N/A	An indication of whether US National Parks occur within 2,500 m of potential dam locations designated for potential hydropower development. “1” indicating “yes,” and “0” indicating “no.”
Wild and Scenic Rivers Near Potential Dam	WSRd	N/A	An indication of whether US designated Wild and Scenic Rivers occur within 2500 m of potential dam locations designated for potential hydropower development. “1” indicating “yes,” and “0” indicating “no.”
303d Listed Waterbodies Near Potential Dam	WQd	Number	Number of 303d listed waterbodies occurring within 500 m of potential dam locations designated for potential hydropower development. Under the Clean Water Act (1977), Section 303(d), states are required to specify designated uses for all waterways (e.g., public water supply, protection of fish and wildlife, recreation). In addition, each state must identify and adopt water quality criteria that support each designated use category and determine a list of streams that are not meeting their designated uses (303d List).
Whitewater Boating Runs Near Potential Dam	AWRAFTd	Number	Number of whitewater boating runs (launch/take-out point combinations) occurring within 500 m of potential dam locations designated for potential hydropower development.
Waterfalls Near Potential Dam	FALLSd	Number	Number of waterfalls occurring within 800 m of potential dam locations designated for potential hydropower development.
Total Boat Ramps Near Potential Dam	BOATRMPd	Number	Number of developed and undeveloped boat ramps occurring within 500 m of potential dam locations designated for potential hydropower development.
Fishing Access Locations Near Potential Dam	FISHACCd	Number	Number of fishing access locations occurring within 500 m of potential dam locations designated for potential hydropower development.
Estimated Surface Water Use	S_WUSEd		Estimated surface water use [(L/d)/km^2] within the 8-HUC watershed containing each dam location.
Estimated Groundwater Use	G_WUSEd		Estimated groundwater use [(L/d)/km^2] within the 8-HUC watershed containing each dam location.
Urbanization Near Potential Dam	URBAN_LC	%	Percentage of area composed of low-intensity, moderate-intensity, and high-intensity urbanization within each NHDPlus watershed containing each dam location.

Estimated Population Density	POPDEN	Number	Estimated population density (individuals/km^2) within each NHDPlus watershed containing each dam location.
Dams Per Watershed of Potential Dam	L_DAMSd	Number	Number of dams occurring within each NHDPlus watershed containing each dam location.
Dams Upstream of Each Potential Dam	N_DAMSd	Number	Number of dams occurring in the drainage network upstream of each NHDPlus watershed containing each dam location.
Land Disturbance Index	LD_IDXd	Number	The Land Disturbance Index for each NHDPlus watershed containing each dam location. Land disturbance indices were created for NHDPlus catchments through the National Fish Habitat Action Plan (http://ecosystems.usgs.gov/fishhabitat/). A cumulative disturbance index was created for approximately 2.23 million US river reaches (NHD flow lines) from landscape anthropogenic activities using urban areas, agricultural areas, roads, dams, mines, population density, and point-source pollution sites. Lower values indicate higher disturbance to aquatic habitats.

8. HSDM1 CROSSWALK

ORNL's HydroSource team has established a database crosswalk between HSDM1 data components and external frameworks. The HSDM1 crosswalk provides key linkages to major external database frameworks, which enables multiple capabilities for extending HSDM1 and providing added value for advancing hydropower research and supporting US hydropower sustainability.

Table 1. HSDM1 crosswalk

Data Component	Cross-Walk ID	External Source	Source Description
HS_EF_Dam	FcDAMS_ID	SO_FERC	The Federal Energy Regulatory Commission's (FERC) FERC DAMS Database (non-public), FERC eLibrary, and FERC Form 1.
HS_EF_Plant	FcDocket		
HS_Mitigation			
HS_PPA	*FcForm1ID		
HS_EF_Plant	EIA_PtID	SO_EIA	Forms 860, 906, 920, and 923 from the Energy Informaiton Administration (EIA).
HS_EF_Unit	EIA_UnID		
HS_EF_Dam	NID_ID1	SO_NID	The National Inventory of Dams' (NID) congressionally authorized database documenting dams in the United States and its territories. NID is maintained and published by the U.S. Army Corps of
HS_NPD_Dam			
HS_RefurbUpgrade	IIR_PtID	SO_IIR	Industrial Info Resources (IIR) Database containing information on power, energy, and industrial infrastructure markets.
HS_EF_Turbine	IIR_TrID		
HS_FleetIntel	EUCG_ID	SO_EUCG	The Electric Utility Cost Group's (EUCG) Hydroelectric Productivity Committee (HPC) Database containing hydropower performance and cost data.
HS_FleetIntel	hydroAMP_ID	SO_hydroAMP	Hydropower Asset Condition Assessments (hydroAMP) from the U.S. Bureau of Reclamation (USBR) and U.S. Army Corps of Engineers (USACE).
HS_mResFlowline	COMID	SO_NHDPlus	The National Hydrography Dataset Plus (NHDPlus) is a geo-spatial, hydrologic framework dataset built by the U.S. Environmental Protection Agency's (EPA) Office of Water, assisted by the U.S. Geological Survey.
HS_HUC_8	HUC_8		
HS_HUC_6	HUC_6		
HS_HUC_2	HUC_2	SO_WBD	The Watershed Boundary Dataset (WBD) defines the areal extent of surface water drainage to a point, accounting for all land and surface areas.
****HS_HUC_8***	HUC_8	SO_NRCS	Watershed boundary data generated by the Natural Resources Conservation Service (NRCS).
HS_FleetIntel	*GADS_ID	SO_GADS	Reliability information for total unit and major equipment groups from the North American Electric Reliability Corporation's (NERC) Generating Availability Data System (GADS).

*HS_HUC_8 is listed twice to distinguish HUC-8 boundaries delineated from separate sources.

Source Confidentiality	
	Potential Future Linkage
	Public and Nonpublic
	Nonpublic
	Public

GLOSSARY

Term	Definition
Attribute	Refers to variables (e.g., height, weight, slope, material composition, age, primary participant, and owner) associated with HSDM1 data components.
Confidentiality	Category classifying the general availability of each data component (i.e., public, upon request, nonpublic, varies). "Public" denotes open access HSDM1 data (i.e., free of cost or other barriers to acquisition). "Upon request" denotes HSDM1 data available to anyone upon request. There are no sharing restrictions for these data, but additional oversight is in place to help ensure their appropriate usage. "Nonpublic" denotes HSDM1 data with sharing restrictions that limit their availability to others (e.g., proprietary, export-controlled, business sensitive, official use only). "Varies" denotes HSDM1 data containing a mixture of public and nonpublic information.
Database indices	Index fields that compose data components (i.e., primary key, foreign key, external crosswalk, potential future key).
Data components	Primary building blocks that make up the HSDM1 schema. They are essentially different types of data objects that store (1) related sets of attributes and (2) database indices (i.e., primary key, foreign key, external crosswalk key potential future key) that provide connectivity among and beyond data components within HSDM1.
External crosswalk key	The data component index field is an external crosswalk key.
Foreign key	The data component index field is a foreign key.
Geospatial point layer	Data component type representing discrete geospatially referenced locations of zero-dimensional common features (e.g., addresses, place names).
Geospatial polygon layer	Data component type representing discrete geospatially referenced locations of common area features (e.g., hydropower project boundaries, waterbodies, land ownership, land cover).
Geospatial polyline layer	Data component type representing discrete geospatially referenced locations of common linear features (e.g., flow lines, transmission lines, roads).
HSDM1 crosswalk	Provides key linkages to major external database frameworks, enabling multiple capabilities for extending HSDM1 and providing added value for advancing hydropower research and supporting US hydropower sustainability.

Nonspatial table	Data component type representing tabular data that contain a related set of attributes. Nonspatial tables do not explicitly represent geospatially referenced locations of a common feature type, contain time-series data, or function as a relational table within HSDM1.
Potential future key	The data component index field is a potential future key.
Primary key	The data component index field is a primary key.
Properties	Description of attributes and database indexes within HSDM1 (i.e., field, alias, unit of measurement, description).
Relational table	Data component type that stores and indexes unique index fields from two separate data components to enable a many-to-many relationship.
Research theme	Primary subject matter pertaining to a common overarching goal(s) of WPTO-funded ORNL research projects.
Time-series	Data component type representing a set of attributes containing time-series information. Time-series data components within HSDM1 are all nonspatial because they do not explicitly represent geospatially referenced locations of a common feature type.