Oregon Flood Hazard Data Standard

Version 2.0

December, 2014

Version 2.0 Endorsed by the Oregon Geographic Information Council
December 17, 2014

Version 1.0 endorsed by the Oregon Geographic Information Council
December 20, 2006

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1.0 Introduction

The Hazards Framework is a collection of spatially referenced digital representations of potential natural hazards. Data elements in the Hazards Framework include: channel migration, coastal erosion, earthquakes, debris flows, drought areas, dust storm occurrences, flooding, landslides, tsunami inundation, volcanic hazards, and wildfire. Under the direction of the Oregon Geographic Information Council (OGIC), the Oregon Framework Implementation Team delegated development of a Flood Hazard Data Standard to the Hazards Framework Implementation Team (Hazard-FIT), which, in turn, delegated the task to the Flood Hazard Working Group (Working Group).

This document, developed by the Working Group, updates the existing standard and data dictionary for the flood hazard element of the Hazard Framework Theme.

1.1 Mission and Goals of Standard

The Oregon Flood Hazard Data Standard (Flood Standard) provides a consistent and maintainable structure for data producers and users to ensure the compatibility of datasets within the same framework feature set (horizontal integration) and between other framework feature sets and themes (vertical integration).

The goal of the Flood Standard is to ensure that flood hazard data are easily exchanged and usable for mitigation planning, response, and recovery at the state and local level. This standard is intended to increase confidence in the flood hazard element by ensuring data and metadata integrity.

1.2 Relationship to Existing Standards

The Working Group developed the Flood Standard with existing state and federal standards in mind. This connection to existing standards should be maintained to ease information flow between agencies.

A major component of the flood hazard element is flood study data. The Federal Emergency Management Agency (FEMA) is the primary source of flood study data nationally. FEMA uses the data to produce Flood Insurance Rate Maps (FIRMs) that are the essential tool for administering the National Flood Insurance Program (NFIP). The underlying flood study data are published as spatial databases called Digital Flood Insurance Rate Maps (DFIRMs). FEMA has developed detailed “Guidelines and Standards for Flood Risk Analysis and Mapping” (FEMA Guidelines) to ensure a consistent DFIRM database structure. The FEMA Guidelines present a comprehensive and integrated database schema for capturing and archiving the elements of flood study data. The Flood Standard has adopted applicable portions of the FEMA Guidelines.

New flood study data are being developed using Oregon Framework elements, in particular elevation, hydrography, land use/land cover, geodetic control, and imagery. Base map data included in FEMA DFIRMs also may be supplied from Oregon Framework elements and local

data sources, including imagery, transportation, hydrography, and administrative and cadastral boundaries. FEMA Guidelines specify minimum requirements for these base map elements. The Flood Standard does not address the Framework elements or local data used by FEMA for its base maps.

The other major component of the flood hazard element is high-water mark (HWM) data. Following large flood events agencies may collect HWMs to document the extent of actual flooding. The U.S. Geological Survey (USGS) and U.S. Army Corps of Engineers (USACE) are primary collectors of HWM data. The USGS has developed a "High-Water Mark Standard Operations Plan" (HWM-SOP) and "Draft HWM Database" for capturing information in a consistent manner. The Flood Standard has adopted the HWM database structure developed by the USGS and outlined in its HWM-SOP.

1.3 Description of Standard

The Flood Standard describes essential characteristics and data structures for the flood hazard elements in Oregon. The Flood Standard addresses point, line, and polygon elements, and associated tabular data that characterize flood inundation, either modeled or observed. These elements include flood inundation areas, FEMA flood zones (including amendments), HWMs, modeled cross-sections, flood study reaches, and other information necessary to characterize and

regulate activities in a floodplain. Maintenance of flood hazard elements is addressed in a separate stewardship plan.

1.4 Applicability and Intended Use of Standard

The Flood Standard is applicable to flood hazard elements maintained in Oregon's Hazard Framework. The Flood Standard enables users to understand how the flood hazard elements were produced and what uses are deemed appropriate by the authoritative data sources.

The Flood Standard is not intended to replace FEMA Guidelines, USGS HWM standards, or other federal standards, nor is the data subject to this standard meant as a replacement for any official or regulatory publications by FEMA, USGS, or any other federal agency.

1.5 Standard Development Procedures

The Working Group amended the Flood Standard and published it on the Geospatial Enterprise Office standards web page on August 5, 2014. (http://www.oregon.gov/DAS/CIO/GEO/pages/standards/standards.aspx).

A public review and comment period commenced with the publication of the first revision on Aug 5, 2014. After incorporating comments, the Oregon Geographic Information Council endorsed the Flood Standard on December 17, 2014.

1.6 Maintenance of Standard

The Flood Standard will be revised as needed, initiated by members of the Hazards-FIT or the Working Group.

2.0 Body of the Standard

2.1 Scope and Content of the Standard

This standard encompasses publicly available geographical and associated tabular data developed by federal, state, and local governments, along with required metadata. Flood hazard elements include of flood study, observed inundation, and HWM data that are essential to local, state, and federal governments that manage and mitigate flood hazards.

2.2 Need for the Standard

Local, state, federal agencies depend on flood hazard data to manage their NFIP obligations, for flood hazard management, and for emergency planning and response. Flood hazard data is also

used to inform habitat restoration, infrastructure design, mine site reclamation, and real estate activities.

Even though federal agencies host official flood study and HWM data, there is no statewide, seamless set of flood hazard elements to support multi-jurisdictional, non-regulatory hazard planning. In addition to defining a seamless data set, the Flood Standard incorporates flood hazard elements to supplement commonly referenced FEMA DFIRMs.

2.3 Participation in Standards Development

The Department of Geology and Mineral Industries (DOGAMI) prepared an initial revision of the Flood Standard and circulated it among members of the Hazards-FIT and the Flood Subcommittee of the statewide Interagency Hazard Mitigation Team, also known as the Oregon Silver Jackets. Four meetings were held (11/06/2013, 03/04/2014, 05/06/2014, and 07/01/2014) to discuss and comment upon the revised standard. Comments also were submitted by email and communicated by telephone to DOGAMI. Participants in development of the current version included:

Jed Roberts, Oregon Department of Geology and Mineral Industries
Chris Shirley, Oregon Department of Land Conservation and Development
Steve Lucker, Oregon Department of Land Conservation and Development
Anu Acharya, Oregon Water Resources Department
Joseph Murray, Oregon Emergency Management
Glen Hess, U.S. Geological Survey, Oregon Water Science Center
Julie Amman, U.S. Army Corps of Engineers, Portland District
Andy Bryant, National Weather Service, Portland Office
Ted Perkins, Federal Emergency Management Agency, Region 10

The Department of Land Conservation and Development (DLCD) prepared the initial draft of Floodplain Data Exchange Standard 1.0 and circulated it among members of the Hazards-FIT. Two meetings were held (09/25/2006 and 10/25/2006) to discuss and comment upon the draft

standard. Comments also were submitted by email and communicated by telephone to DLCD. Participants in development of version 1.0 included:

Steve Barnett, GIS Program Manager, Linn County
Susan Blohm, City of Salem
Bill Clingman, Lane Council of Governments
Randy Dana, Oregon Department of Land Conservation and Development, Coastal Program
Mark Darienzo, Oregon Department of Land Conservation and Development
Gail Ewart, Department of Administrative Services-Geospatial Enterprise Office
Chris Shirley, Oregon Department of Land Conservation and Development
Nancy Tubbs, USGS Geospatial Liaison for Oregon
Christine Valentine, Oregon Department of Land Conservation and Development

2.4 Integration with Other Standards

Flood hazard elements populated from FEMA DFIRMs or USGS HWM databases must be incorporated as-is where FEMA Guidelines and USGS HWM-SOP have been adopted in this standard.

Flood hazard elements are integrated with the "Oregon Hydrography Data Standard 2.0" (Hydrography Standard) developed by the Hydrography Framework Implementation Team. The Hydrography Standard adopts the USGS National Hydrographic Dataset (NHD) structure. Flood hazard elements are associated with the NHD through the reach code attribute, which is a unique identifier in the addressing system used to locate stream segments.

Flood hazard elements populated from FEMA DFIRMs are registered to the base map elements provided to FEMA. These may include the following elements from Oregon Framework:

- Elevation
- Geodetic control
- Imagery
- Transportation
- Administrative boundaries
- Hydrography

Flood hazard elements also may relate spatially to the wetlands, vegetation (riparian), levee, and dams data standards, since floodplains interact with these elements.

2.5 Technical and Operation Context

2.5.1 Data Environment

Flood hazard elements may be comprised of point, line, or polygon features, and associated tabular data. The exchange formats for geographical data is the Esri shapefile,

a format supported by all GIS software, and the Esri file geodatabase, a format supported by GIS software most commonly used by local, state, and federal agencies. Information about the shapefile and file geodatabase formats may be found at the Esri website (http://www.esri.com).

2.5.2 Reference Systems

Flood hazard elements are referenced to the Oregon Statewide Lambert coordinate system. The Oregon Statewide Lambert coordinate system was selected because it is the standard for Oregon Framework elements. Projection parameters of source data contributed by custodial stewards must be clearly documented in the metadata accompanying the shapefiles and feature classes. The source coordinate system is recorded for each feature since each flood hazard element is compiled from many sources.

Horizontal Datum: Flood hazard elements are referenced to the North American 1983 Horizontal Datum (NAD83), consistent with Oregon Lambert coordinate system. The horizontal unit is international feet. The source horizontal datum is recorded for each feature since each flood hazard element is compiled from many sources.

Vertical Datum: Flood hazard elements are referenced to the North American Vertical Datum of 1988 (NAVD88), wherever possible. The source vertical datum is recorded for each feature since each flood hazard element is compiled from many sources. In some cases the source vertical datum cannot be reliably converted to NAVD88.

2.5.3 Integration of Themes

Flood hazard elements must be registered to the NHD, as adopted in the Hydrography Standard. Elements are associated with the NHD by reach code.

2.5.4 Encoding

Flood hazard elements are encoded in both the Esri shapefile and file geodatabase formats. The Esri shapefile format limits field name lengths to 10 characters. No spaces or special characters, besides the underscore, maybe used in field names. While field names in file geodatabase feature classes may have up to 64 characters, only 10 characters will be used to conform to shapefile limitations and maintain consistency.

For flood hazard elements populated from FEMA DFIRMs or USGS HWM databases feature record formats should, whenever possible, align with the database schemas described in FEMA Guidelines and USGS HWM-SOP, respectively. Such alignment allows for efficient maintenance of flood hazard elements.

Section 3 of this standard presents a detailed data model.

2.5.5 Resolution

Flood hazard elements may contain data compiled at different map reference scales. Applicable scales range from 1:2,400 to 1:24,000. This wide range of scales reflects the variable resolution of flood hazard mapping in the state. Larger scale data is most often

available in urban areas where higher building densities potentially result in more costly flood damage. Larger scale data is also required in urban areas to visualize the smaller parcel size typically found there. Conversely, smaller scale data has typically been developed for use in rural or industrially developed areas where parcel sizes tend to be large and structures are dispersed.

This range of scales, even within one element, makes it impossible to document source map scale in element metadata. Source map scale is, therefore, recorded for each feature. This also makes it possible to continually improve element resolution by providing for the incorporation of new, higher resolution features as they become available.

2.5.6 Accuracy

Flood hazard elements support varying levels of horizontal and vertical positional accuracy.

Horizontal accuracy should be recorded at least at the metadata level for each element using the National Standards for Spatial Data Accuracy (NSSDA) radial accuracy procedures, which report the radius of a circle of uncertainty, such that the true location of test points falls within a circle 95 percent of the time.

The minimum horizontal accuracy (error tolerance) for elements populated from FEMA DFIRMs is that of the default base map used by FEMA – the USGS Digital Orthophoto Quadrangle (DOQ) – which has an NSSDA radial accuracy of 38 feet, the FEMA minimum standard for community supplied data.

Vertical accuracy should be recorded at least at the metadata level for each element and shall be measured against professionally surveyed vertical benchmarks that reference a national datum.

Vertical accuracy for HWM elements should be reported according to the USGS HWM-SOP rating levels.

RATING	***ACCURACY (FT.)***
Excellent (E)	+/- 0.02
Good (G)	+/- 0.05
Fair (F)	+/- 0.10
Poor (P)	+/- 0.20
Very Poor (VP)	> +/- 0.20

For elements populated from FEMA DFIRMs vertical accuracy should be reported according to the NSSDA, which defines vertical accuracy at the 95 percent confidence level. This means that the true location of test points falls within a linear uncertainty value 95 percent of the time. Vertical accuracy = $RMSE_Z$ * 1.96, where $RMSE_Z$ is the square root of the mean of the squared errors in elevation check points used to evaluate the vertical accuracy of a digital dataset. $RMSE_Z$ must be less than or equal to 1.2 feet in hilly terrain. In moderate or flat terrain, an $RMSE_Z$ of less than or equal to 0.6 feet is

expected. These values are derived from FEMA minimum standards for community-supplied data.

2.5.7 Edge Matching

Flood hazard elements are intended to be seamless across Oregon. Edge matching will be implemented by the Horizontal Steward according to established business rules. Features populated from FEMA DFIRMs are sliced at county boundaries to maintain consistency with the FEMA data structure.

2.5.8 Feature Identifier

The feature identifier will be created and maintained by the Horizontal Steward for flood hazard elements. There are three feature types: polygons, lines, and points.

2.5.8.1 Polygons

Polygons are geospatial objects that represent modeled or observed flood inundation areas.

2.5.8.2 Lines

Lines are geospatial objects that represent flood study reaches (profile baselines), modeled cross-section locations, and FEMA whole-foot base flood elevation locations.

2.5.8.3 Points

Points are geospatial objects that represent HWM locations and FEMA Letter of Map Changes (LOMC) locations.

2.5.9 Attributes

Attributes are any of the additional information this is collected and shared in relation to the representation of flood hazard elements. See Section 3 for the specification of minimal and optional characteristics for flood hazard element polygons, lines, and points.

2.5.10 Transactional Updating

Transactional updating processes will be explored as a functional component of an Oregon flood hazard database. This database is under constant development (funding

contingent) and will be hosted at the Department of Land Conservation and Development.

Through the business rules identified in the Flood Standard and the stewardship plan that will be employed for managing flood hazard elements, it should be possible to manage the regular merging of locally managed flood hazard data into a statewide data structure.

2.5.11 Records Management

Past versions of an Oregon flood hazard database will be maintained and available for retrieval through versioned releases hosted by the Horizontal Steward.

2.5.12 Metadata

The Flood Standard follows the Federal Geographic Data Committee (FGDC), Content Standard for Digital Geospatial Metadata. Metadata detailing the characteristics and quality of submitted flood hazard data must be provided. Metadata must provide sufficient information to allow the user to determine if that dataset will meet the intended purpose, as well as telling the user how to access the data.

The following standard language shall be included in metadata associated with flood study data:

> *Flood hazard elements do not depict all flood hazards in the State of Oregon. Flood studies tend to focus on developed areas, generally with drainage areas greater than one square mile. Not all water courses in the State of Oregon have mapped flood inundation areas (or zones). Furthermore, land areas outside of mapped flood zones are subject to flooding. The State of Oregon makes no warranty whatsoever as to the accuracy or completeness of any information contained in flood hazard elements. The State of Oregon shall not be responsible for any claims attributable to errors, omissions or other inaccuracies in the information contained in flood hazard elements. In no event shall the State of Oregon be liable for direct, indirect, special, incidental or consequential loss or damage of any nature caused to any person, party or entity as a result of use of*

the information set forth herein. The State of Oregon hereby disclaims liability for any such loss or damage.

3.0 Data Characteristics

3.1 Minimum Data Elements

3.1.1 Polygons

Table 1.

FEMA_FLD_HAZ_AR *- FEMA flood insurance study inundation zones.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
FLD_AR_ID	Text	25	Unique feature identifier: sequential, unique id generated by the horizontal steward.
COUNTY	Text	50	Identifies county inundation zone falls within.
STUDY_TYP	Text	28	The type of flood risk project performed for flood hazard identification. Acceptable values for this field are listed in the D_Study_Typ table in the FEMA Guidelines.
FLD_ZONE	Text	17	Flood zone designation. These zones are used by FEMA to designate the SFHAs for insurance rating purposes. Acceptable values for this field are listed in the D_Zone table in the FEMA Guidelines.
SFHA_TF	Text	1	Special Flood Hazard Area. If the area is within a SFHA this field would be true. This field will be true for any area coded as an A or V flood zone area. It should be false for any X or D flood areas. Acceptables values for this field are listed in the D_TrueFalse table in the FEMA Guidelines.
STATUS	Text	11	Status of the FEMA flood insurance study; either effective, preliminary, or draft.
SOURCE	Text	50	Source of the flood study inundation zone; either DFIRM, Q3, or other (specified).
EFF_DATE	Text	10	Effective date of flood insurance study; required if applicable.
PUB_DATE	Text	10	Publish date of draft or preliminary flood insurance study; required if applicable.
OTHER_FLD_HAZ_AR *- Non-FEMA flood insurance study inundation zones.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
FLD_STU_ID	Text	25	Unique feature identifier: sequential, unique id generated by the horizontal steward.
REACH_ID	Text	25	Lookup to unique id for associated study reach.
RECURR	Text	50	Recurrence interval (or annual exceedence probability).
SRC_ENTIT	Text	100	Entity that produced the flood study.
PUB_DATE	Text	20	Date flood study was published.
OBS_INUNDATION_AR *- Observed inundation zones.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
FLD_INU_ID	Text	25	Unique feature identifier: sequential, unique id generated by the horizontal steward.
WTR_NM	Text	200	Stream(s) and/or water body(s) where inundation was mapped.
EVENT_NAME	Text	200	Name of flood event.
EVENT_STRT	Text	10	Date flood event started.
SRC_ENTIT	Text	100	Entity that produced the inundation zone.
PUB_DATE	Text	20	Date inundation zone was published.

3.1.2 Lines

Table 2.

FEMA_PROFIL_BASLN *- FEMA flood insurance study reaches (aka profile baselines).*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
BASELN_ID	Text	25	Unique feature identifier: sequential, unique id generated by the horizontal steward.
COUNTY	Text	50	Identifies county profile baseline falls within.
WTR_NM	Text	100	The formal name of the surface water feature.
WTR_TYP	Text	38	
STUDY_TYP	Text	28	Describes the type of flood risk project performed for flood hazard identification. Acceptable values for this field are listed in the D_Study_Typ table in the FEMA Guidelines.
R_ST_DESC	Text	254	Describes the location of the start of the flood risk project reach.
R_END_DESC	Text	254	Describes the location of the end of the flood risk project reach.
STATUS	Text	11	Status of the FEMA flood insurance study; either effective, preliminary, or draft.
SOURCE	Text	50	Source of the flood study inundation zone; either DFIRM, Q3, or other (specified).
EFF_DATE	Text	10	Effective date of flood insurance study; required if applicable.
PUB_DATE	Text	10	Publish date of draft or preliminary flood insurance study; required if applicable.
NHD_RCH_UP	Text	14	Reach code for stream reach in the National Hydrography Dataset at the upstream terminus of the study reach.
NHD_RCH_DN	Text	14	Reach code for stream reach in the National Hydrography Dataset at the downstream terminus of the study reach.
FEMA_XS *- FEMA flood insurance study cross-sections.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
XS_LN_ID	Text	25	Unique feature identifier: sequential, unique id generated by the horizontal steward.
BASELN_ID	Text	25	Lookup to unique id for associated FEMA flood insurance study reach (or profile baseline).
COUNTY	Text	50	Identifies county cross-section falls within.
WTR_NM	Text	100	The name of the stream or water body.
XS_LTR	Text	12	Cross section letter. This is the letter or number that is assigned to the cross section on the hardcopy FIRM and in the FIS report. This field is populated when the cross section is lettered.
WSEL_REG	Double	Default	The modeled water-surface elevation for the 1% annual chance flood event in the stream channel at this cross-section.
LEN_UNIT	Text	16	Unit indicates the measurement system used for the water-surface and streambed elevations. Acceptable values for this field are listed in the D_Length_Units table in the FEMA Guidelines.
V_DATUM	Text	17	Vertical datum. Acceptable values for this field are listed in the D_V_Datum table in the FEMA Guidelines.
STATUS	Text	11	Status of the FEMA flood insurance study; either effective, preliminary, or draft.
SOURCE	Text	50	Source of the flood study inundation zone; either DFIRM, Q3, or other (specified).

EFF_DATE	Text	10	Effective date of flood insurance study; required if applicable.
PUB_DATE	Text	10	Publish date of draft or preliminary flood insurance study; required if applicable.
NHD_RCH_CD	Text	14	Reach code for stream reach the cross-section intersects in the National Hydrography Dataset.
FEMA_BFE *- FEMA flood study base flood elevation lines.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
BFE_LN_ID	Text	25	Unique feature identifier: sequential, unique id generated by the horizontal steward.
BASELN_ID	Text	25	Lookup to unique id for associated FEMA flood insurance study reach (or profile baseline).
COUNTY	Text	50	Identifies county BFE falls within.
ELEV	Double	Default	The rounded, whole-foot elevation of the 1% annual chance flood.
LEN_UNIT	Text	16	Unit indicates the measurement system used for the water-surface and streambed elevations. Acceptable values for this field are listed in the D_Length_Units table in the FEMA Guidelines.
V_DATUM	Text	17	Vertical datum. Acceptable values for this field are listed in the D_V_Datum table in the FEMA Guidelines.
STATUS	Text	11	Status of the FEMA flood insurance study; either effective, preliminary, or draft.
SOURCE	Text	50	Source of the flood study inundation zone; either DFIRM, Q3, or other (specified).
EFF_DATE	Text	10	Effective date of flood insurance study; required if applicable.
PUB_DATE	Text	10	Publish date of draft or preliminary flood insurance study; required if applicable.
NHD_RCH_CD	Text	14	Reach code for stream reach the base flood elevation line intersects in the National Hydrography Dataset.
OTHER_STUDY_REACH *- Non-FEMA flood study reaches.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
REACH_ID	Text	25	Unique feature identifier: sequential, unique id generated by the horizontal steward.
WTR_NM	Text	100	The formal name of the surface water feature.
SRC_ENTIT	Text	100	Entity that produced the flood study.
PUB_DATE	Text	20	Date flood study was published.
NHD_RCH_UP	Text	14	Reach code for stream reach in the National Hydrography Dataset at the upstream terminus of the study reach.
NHD_RCH_DN	Text	14	Reach code for stream reach in the National Hydrography Dataset at the downstream terminus of the study reach.
OTHER_XS *- Non-FEMA flood study cross-sections.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
O_XS_LN_ID	Text	25	Unique feature identifier: sequential, unique id generated by the horizontal steward.
REACH_ID	Text	25	Lookup to unique id for associated flood study reach.
WTR_NM	Text	100	The name of the stream or water body.
LEN_UNIT	Text	16	Unit indicates the measurement system used for the water-surface.

V_DATUM	Text	17	Vertical datum.
SRC_ENTIT	Text	100	Entity that produced the flood study.
PUB_DATE	Text	10	Date flood study was published.
NHD_RCH_CD	Text	14	Reach code for stream reach the cross-section intersects in the National Hydrography Dataset.

3.1.3 Points

Table 3.

FEMA_LOMC *- FEMA Letter of Map Change (LOMC) locations.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
LOMC_ID	Text	25	Unique feature identifier: sequential, unique id generated by horizontal steward.
COUNTY	Text	50	Identifies county LOMC falls within.
EFF_DATE	Text	10	Effective date of the LOMC.
CASE_NO	Text	13	The case number of the LOMC that is assigned by FEMA.
STATUS	Text	12	Status of the LOMC. Acceptable values for this field are listed in the D_LOMC_Status table in the FEMA Guidelines.
HWM_POINTS *- High-water mark (HWM) locations.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
HWM_ID	Text	25	Unique feature identifier: sequential, unique id generated by horizontal steward.
AGENCY	Text	100	Agency that collected the HWM.
AGENCY_ADD	Text	200	Agency address.
AGENCY_CIT	Text	100	Agency city.
AGENCY_ST	Text	2	Agency state.
AGENCY_ZIP	Text	5	Agency zip code.
EVENT_NAME	Text	200	Name of flood event.
EVENT_STRT	Text	10	Date flood event started.
WTR_NM	Text	100	Name of stream or water body.
LAT_DD	Text	25	HWM point latitude in decimal degrees.
LONG_DD	Text	25	HWM point longitude in decimal degrees.
H_DATUM	Text	5	Horizontal datum; acceptable values = NAD27, NAD83, WGS84
ELEV_FT	Text	20	Elevation in feet.
V_DATUM	Text	6	Vertical datum; acceptable values = NGVD29, NAVD88
HWM_QUALIT	Tex	30	Quality of the HWM; acceptable values = Excellent (+/- 0.02 ft), Good (+/- 0.05 ft), Fair (+/- 0.1 ft), Poor (+/- 0.2 ft), Very Poor (> +/- 0.20 ft)

3.2 Optional Data Elements

3.2.1 Polygons

Table 4.

FEMA_FLD_HAZ_AR *- FEMA flood insurance study inundation zones.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
ZONE_SUBTY	Text	57	This field captures additional information about the flood zones not related to insurance rate purposes. Acceptable values for this field are listed in the D_Zone_Subtype table of the FEMA Guidelines.
STATIC_BFE	Double	Default	Populated for areas that have been determined to have a constant Base Flood Elevation (BFE) over a flood zones.
V_DATUM	Text	17	Vertical datum. Acceptable values for this field are listed in the D_V_Datum table in the FEMA Guidelines.
DEPTH	Double	Default	Depth for Zone AO areas.
LEN_UNIT	Text	16	Indicates the measurement system used for the BFEs and/or depths. Acceptable values for this field are listed in the D_Lenght_Units table in the FEMA Guidelines.
VELOCITY	Double	Default	The velocity measurement of the flood flow in the area.
VEL_UNIT	Text	20	The unit of measurement for the velocity. Acceptable values for this field are listed in the D_Velocity_Units table in the FEMA Guidelines.
AR_REVERT	Text	17	If this area is Zone AR in the Fld_Zone field, this field would hold the zone that area would revert to if the AR zone were removed. Acceptable values for this field are listed in the D_Zone table in the FEMA Guidelines, but should only include one of AE, AO, AH, A, and X domain values.
AR_SUBTRV	Text	57	If this area is Zone AR in the Fld_Zone field, this field would hold the zone subtype that area would revert to if the AR zone were removed. Acceptable values for this field are listed in the D_Zone_Subtype table in the FEMA Guidelines, and must be one of the allowable subtypes for Zones AE, AO, AH, A, or X.
BFE_REVERT	Double	Default	If zone is Zone AR in Fld_Zone field, this field would hold the static BFE for the reverted zone.
DEP_REVERT	Double	Default	If zone is Zone AR in Fld_Zone field, this field would hold the depth for the reverted zone.
DUAL_ZONE	Text	1	If the flood hazard areas shown on the effective FIRM shall be designated as “dual” flood insurance rate zones, this field will the coded as true. Acceptable values for this field are listed in the D_TrueFalse table in the FEMA Guidelines.
FIS_LINK	Text	254	Link to the Flood Insurance Study report associated with this flood zone.
OTHER_FLD_HAZ_AR *- Non-FEMA flood insurance study inundation zones.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
ZONE_SUBTY	Text	57	Zone designation within the flood zone; example: floodway.
STATIC_WSEL	Double	Default	Populated for areas that have been determined to have a constant water surface elevation (WSEL) over a flood zone.
V_DATUM	Text	17	Vertical datum.

DEPTH	Double	Default	For areas where a depth of flooding is defined within the flood zone.
LEN_UNIT	Text	16	Indicates the measurement system used for the WSELs and/or depths.
REP_LINK	Text	254	Link to technical report describing the flood study.
OBS_INUNDATION_AR *- Observed inundation zones.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
EVENT_END	Text	10	Date of flood event end.
TOPO_SRCE	Text	100	Source of topographic data inundation was mapped on.
REP_LINK	Text	254	Link to report describing the development of this inundation zone.

3.2.2 Lines

Table 5.

FEMA_PROFIL_BASLN *- FEMA flood insurance study reaches (aka profile baselines).*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
FLD_PROB1	Text	254	Description of the flooding problems by the flooding source.
FLD_PROB2	Text	254	Additional room for description of the flooding problems by the flooding source.
FLD_PROB3	Text	254	Additional room for description of the flooding problems by the flooding source.
FIS_LINK	Text	254	Link to the Flood Insurance Study report associated with this flood zone.
FEMA_XS *- FEMA flood insurance study cross-sections.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
FIS_LINK	Text	254	Link to the Flood Insurance Study report associated with this cross-section.
PROFL_LINK	Text	254	Link to the flood profile page within the Flood Insurance Study report associated with this cross-section.
FEMA_BFE *- FEMA flood study base flood elevation lines.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
FIS_LINK	Text	254	Link to the Flood Insurance Study report associated with this cross-section.
PROFL_LINK	Text	254	Link to the flood profile page within the Flood Insurance Study report associated with this cross-section.
OTHER_STUDY_REACH *- Non-FEMA flood study reaches.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
REP_LINK	Text	254	Link to report describing the development of this flood study.
OTHER_XS *- Non-FEMA flood study cross-sections.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
REP_LINK	Text	254	Link to report describing the development of this flood study.
PROFL_LINK	Text	254	Link to flood profile associated with this cross-section.

3.2.3 Points

Table 6.

FEMA_LOMC *- FEMA Letter of Map Change (LOMC) locations.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
SCALE	Text	5	For Letters of Map Revision (LOMRs) only, the denominator of the effective LOMR scale as a ratio. Acceptable values for this field are listed in the D_Scale table of the FEMA Guidelines.
DOC_LINK	Text	254	Link to LOMC documentation.
HWM_POINTS *- High-water mark (HWM) locations.*			
ITEM NAME	***TYPE***	***WIDTH***	***DESCRIPTION***
APPR_AGNCY	Text	100	Agency that approved the HWM point.
APPR_DATE	Text	10	Approval date.
EVENT_DESC	Text	254	Description of flood event.
EVENT_END	Text	10	Date flood event end.
HWM_DESC	Text	254	Description of HWM.
BANK	Text	5	Stream bank when looking downstream; acceptable values = Left, Right
HWM_TYPE	Text	50	Type of HWM; acceptable values = Mud, Debris, Clear Water, Vegetation Line, Seed Line, Stain Line, Melted Snow Line, Peak at Present (Direct Observation), Other (Note in Description)
HWM_ON	Text	100	Where HWM was found, such as on trees, buildings, utility poles, bridges, etc.
COLLECT_DT	Text	10	Date of collection.
ARRIVAL_TM	Text	7	Time of arrival, local time.
DEPART_TM	Text	7	Time of departure, local time.
CLLCT_METH	Text	100	Collection method.
MARKER	Text	50	Type of HWM marker; acceptable values = Chalk, Tape, Paint, Marker, Nail, Nail and HWM Tag, Stake, Not Marked, Other (Note in Description)
STATUS	Text	12	Approval status; acceptable values = Approved, Not Approved
PEAK_DATE	Text	10	Date of peak stage.
PHOTO_NM	Text	100	Name of photo.
PHOTO_DESC	Text	254	Description of photo.
PHO_LAT_DD	Text	25	HWM point latitude in decimal degrees.
PHO_LON_DD	Text	25	HWM point longitude in decimal degrees.
PHOTO_DATE	Text	10	Date photo was taken.
PHOTO_LINK	Text	254	Link to photo.
REP_LINK	Text	254	Link to report describing collection of this high water mark.

Appendix A. Definition of Terms

Term	**Definition**
Accuracy	**Absolute** - A measure of the location of features on a map compared to their true position on the face of the earth. **Relative** - A measure of the accuracy of individual features on a map when compared to other features on the same map.
Attribute	Attributes are the characteristics of **features**.
Custodial Steward	Agency or organization responsible for specific tasks relating to maintaining certain geospatial data.
Datum	A standard system of reference from which measurements are made.
DFIRM	Digital Flood Insurance Map: a product produced by FEMA used to rate flood insurance policies and manage development in flood prone areas.
DOQ	Digital Ortho Quadrangle: an orthorectified photograph covering an area 3.75-minutes longitude by 3.75-minutes latitude, or in some cases an area of 7-minutes by 7-minutes.
Element	A logical unit within a Framework Theme. Each framework element contains one feature set and its associated tabular data.
Esri	A leading provider of geographic information software.
Feature	Abstraction (point, line or polygon) of a real world phenomenon stored within geospatial software.
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
Floodplain	Land area adjacent to rivers and streams subject to recurring inundation.
High-water mark	The point representing the maximum rise of a body of water over land, particularly during a flood.
Horizontal Steward	The agency or organization responsible for assembling and providing access to a statewide dataset of a particular **type**.
Letter of Map Change	A collective term used to describe official amendments and revisions to NFIP maps that are accomplished by cost-effective administrative procedures and disseminated by letter.
Line	A feature built of vectors connecting at least two points or vertices.

Metadata	Data about data.
NFIP	National Flood Insurance Program
NSSDA	National Standard for Spatial Data Accuracy, developed by Federal Geographic Data Committee.
Polygon	Bounded surface for which the interior configuration is not directly specified.
Resolution	The minimum difference between two independently measured or computed values which can be distinguished by measurement or analytical method being considered or used.
RMSE	A quadratic scoring rule which measures the average magnitude of the error, commonly used to describe positional (vertical or horizontal) accuracy.
USACE	United State Army Corps of Engineers
USGS	United States Geological Survey

Appendix B. Crosswalk to USGS High-Water Mark Database

Oregon Field Name	USGS Field Name
HWM_ID	HWM_ID
AGENCY	Agency_name
AGENCY_ADD	Agency_Address
AGENCY_CIT	City
AGENCY_ST	State
AGENCY_ZIP	Zip
EVENT_NAME	EventName
EVENT_STRT	EventStateDate
WTR_NM	Reach
LAT_DD	Latitude_DD
LONG_DD	Longitude_DD
H_DATUM	HDatum_ID
ELEV_FT	Elev_Ft
V_DATUM	VDatum_ID
HWM_QUALIT	HWM_Quality
APPR_AGNCY	Member_ID
APPR_DATE	Approval_Date
EVENT_DESC	EventName
EVENT_END	EventEndDate
HWM_DESC	Description
BANK	Bank
HWM_TYPE	HWM_Type
HWM_ON	HWM_FoundOn
COLLECT_DT	Collect_Date
ARRIVAL_TM	Arrival_Time
DEPART_TM	Depart_Time
CLLCT_METH	Collect_Method
MARKER	Marker
STATUS	Status
PEAK_DATE	Peak_Date
PHOTO_NM	Photo Name
PHOTO_DESC	Photo Description
PHO_LAT_DD	Latitude DD
PHO_LON_DD	Longitude DD
PHOTO_DATE	Photo Date

Appendix C. Referenced Documents and Web Links

Oregon Coordinate Reference System Standard and the Oregon Lambert Projection: http://www.oregon.gov/DAS/CIO/GEO/pages/coordination/projections/projections.aspx

High-water mark data collection tools. USGS flood inundation mapping science, flood documentation study tools: http://water.usgs.gov/osw/flood_inundation/toolbox/flood.html

FEMA Guidelines and Standards for Flood Risk Analysis and Mapping: http://www.fema.gov/media-library/assets/documents/34953