Paradise Creek and the Clean Water Act: History, Law, Management, Science, and Policy

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Theodore Jeckering

Major Professor: Barbara Cosens, LL.M, J.D., M.S.

Committee Members: Adam Sowards, Ph.D.; Jan Boll, Ph.D.

Department Administrator: Robert Heinse, Ph.D.

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Authorization to Submit Thesis

This thesis of Theodore Jeckering, submitted for the degree of Master of Science with a Major in Water Resources- Law, Management, and Policy and titled "Paradise Creek and the Clean Water Act: History, Law, Management, Science, and Policy," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

Major Professor: ____________________________ Date: ___________
Barbara Cosens, LL.M, J.D., M.S.

Committee Members: ____________________________ Date: ___________
Adam Sowards, Ph.D.

____________________________ Date: ___________
Jan Boll, Ph.D.

Department Administrator: ____________________________ Date: ___________
Robert Heinse, Ph.D.

Abstract

The 1972 Clean Water Act is the primary law for water quality protection in the United States. The Clean Water Act has been recognized as successful in limiting point source pollutants, yet the nonpoint protections are often criticized as ineffective. Nationally 42,457 waters are currently listed as impaired, mostly due to nonpoint pollution. Much of the criticism of nonpoint pollution protection focuses on the lack of mandatory regulation without study of current implementation to determine if management adjustments might also provide a solution. This thesis examines the implementation of the nonpoint source provisions of the CWA in Paradise Creek located in the Inland-Northwest of Idaho and Washington, illustrating that understanding of legacy effects, establishing a longer planning horizon, and resources to implement more extensive monitoring and adjustment of implementation accordingly, will lead to significant improvements in implementation.

Acknowledgements

I would like to acknowledge the many scholars in the fields of: history, law, policy, and science whose previous work has made this thesis possible. Specific acknowledgements to: Barbara Cosens, for serving as an inspiring and patient mentor throughout my time in law school, and throughout the writing of this thesis. Adam Sowards whose passion understanding the past was always contagious. Jan Boll for his encyclopedic knowledge of local watershed management and science. Anyone whose work was cited by this document also receives my sincere thanks and appreciation, I could not have done it without you.

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Dedication

This is dedicated to my parents, who have stood by me and were very supportive throughout my life. Hobbes and Kona were my constant company and always positive influences. My professors have taught me so much. I would also like to recognize my friend Tyrone for listening to me complain, and distracting me with laughter. Kudos to Danny for teaching me to fly-fish while I lived in Idaho. Finally, I would like to acknowledge everyone who has helped me and encouraged me through the four years of law and graduate school, who are much too numerous to name here.

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Chapter 1: Introduction

Thesis Statement

The point source provisions of the CWA are widely heralded as successful, and have been a huge source of progress since the passage in 1972. The CWA has received criticism for the ineffectiveness of the nonpoint provisions, specifically that they do not have a permit system containing the mandatory requirements for individuals that the point source provision does. Total maximum daily loads of pollution are required, but the implementation of best management practices is largely voluntary. Assuming there are good both political and practical reasons to treat point source pollution differently than pollution that involves changes to land use, this thesis investigates the efficacy of the current CWA nonpoint implementation by examining in detail its implementation in Paradise Creek Watershed on the Idaho Washington border.

Research Questions

1. How did Paradise Creek's historical water quality management lead to the current status of water quality in this watershed?
2. To what extent are laws and water quality management plans in Paradise Creek successful in improving water quality; how could management plans better address persistent pollution problems involving multiple pollutants?
3. Can the integration of the historical development in conjunction with the current implementation of the CWA lead to recommendations for improving water quality in Paradise Creek? Does this indicate anything about the CWA in general?

Methodology

After providing background on the CWA and its implementation, this paper will utilize an intensive study of a single watershed, Paradise Creek, in order to better understand the legal, historical, policy, and management of a single watershed. This synthesis will provide further understanding of this localized area, as well as, some aspects of implementation of the CWA in general. This understanding could inform new laws and management plans going forward, as well as further studies of these issues elsewhere. The CWA is a national law, yet each state implements in its own manner.

Legal

This paper will employ legal research and analysis as a tool for understanding the CWA's inspiration, development, legal structure, as well as, the Act's current role in Paradise Creek. Legal research and analysis of a federal statute such as the CWA requires understanding of the laws, regulations, and legal interpretation of the law. The United States has many possible sources of law: the legislative branch creates statutes, the executive branch controls agency regulations, and the judicial system produces case law interpreting these laws.[1]

Once passed by the legislature, a law is implemented by the corresponding agency, for the CWA it is the Environmental Protection Agency ("EPA") together with the states' environmental agencies who implement.[2] This is a "federal-state partnership" where state agencies implement many aspects of the CWA while working with the EPA.[3] The statute forms the requirements of agency action and limitations to that action as well.[4] There often is

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[1] Christine Coughlin, Joan Rocklin, and Sandy Patrick, A Lawyer Writes: a Practical Guide to Legal Analysis 15-32 (Carolina Academic Press, 2008).
[2] Plater, et al., *Environmental Law and Policy- Nature, Law, and Society*, 53, (Aspen Publishers, 2010, 4th ed.).
[3] *Id.*
[4] Richard Seamon, *Administrative Law: A Context and Practice Casebook*, 5-41 (Car. Academic Press, 2013).

considerable discretion for agencies to determine the correct interpretation of the statute, as needed, as long as they are consistent with this framework.[5] Agencies can be delegated legislative, executive, judicial powers, or some combination of these three.[6] Legislative actions by agencies form regulations, which is more efficient and flexible than putting every last detail directly into the statute.[7] An example of creation of these regulations is EPA making CWA pursuant rules governing pollution discharges into the water.[8] Another reason for this discretion is due to agencies' role as specialized experts, for example, the EPA has more capability to implement the CWA due to their scientific expertise on the subject matter.[9] Thus, when examining the CWA it is crucial to look at the scientific basis of agency actions or inaction, in addition to the text of statutes and agency regulations.

In legal analysis, first you look to the text of the statute, when the text of a law is ambiguous, then legislative history.[10] This provides the record of the discussions legislators had while writing the law, while they were discussing the meaning of the statutory language.[11] Legislative history highly technical to prove at trial, and reliant on the actual wording of Senate and House reports.[12] Science is important as the basis of an agencies' decision within the discretion provided. It is beneficial to understand the how the law it interacts with agency regulation to implement the goals of the legislature.

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[5] *Id.*
[6] *Id.*
[7] *Id.*
[8] *Id.*
[9] *Id.*
[10] Coughlin,et al. at 15-32.
[11] *Id.*
[12] *Id.*

Historical

The historical research employed in this paper was conducted by surveying what other historians wrote about the watershed, with research of primary sources as well. Water quality is rarely written about as a main subject matter in history, especially the further back you go, yet is of incredible importance. Despite this, most probably due to water's crucial importance in human life and activity, references to water quality abound in historical materials which describe other events. Paradise Creek's region, the Palouse, has had the benefit of a passionate local environmental historian, Andrew Duffin. Dr. Duffin has written multiple scholarly articles which were later aggregated into his book, *Plowed Under: Agriculture and Environment on the Palouse*. His works have provided an excellent framework for the development of this region. His focus on soil history and erosion is related to many issues related to water quality. The University of Idaho has an excellent collection of local materials, including photographs, maps and other documents. These resources allowed for a history of water quality to be formed.

Policy Analysis of Scientifically Based Management Plans

Sources for the science, management, and policy components of this thesis were an amalgamation of past and current management plans for the Paradise Creek watershed, other government science work, along with research from local scientists developed for the management context. No new data was collected. Government agency science was a significant source of management information due to the availability of reports and wide scope of management context. Government documents are not peer reviewed like academic science, yet they represent agency interpretation of the law and manifest public policy.

According to Coughlin, et al., "'Policy' refers to the broader moral, philosophical, or social goals behind a law[,]" which in the case of the CWA, is achievement of clean water.[13] William Dunn explains in his book, *Public Policy Analysis,* Policy analysis is in inherently a multi-disciplinary approach.[14] Coughlin,et al. describe policy broadly, it can be written into a law, found in history, regulations, and court decisions. [15] Many understandings of policy can also be quite specific, and much less broad than legislatively declared goals for a major environmental law; the executive branch and even individual states can have their own set policy goals established in-house, but in compliance with federal guidelines. Management plans and scientific work inform specific problems and subsequent management action forming local policy. Data gaps are identified and other implementation is locally specific to problems presented by specific pollutants. .

The Single Case Study Method

This thesis will utilize the single case study method looking at water quality in depth in Paradise Creek, in Idaho and Washington. A single case study will not explain whether improved water quality may simply require changes to implementation of the CWA rather than wholesale changes for the nation, but it does show the situation within Paradise Creek. Should improvement be possible in this watershed, this provides some indication that the current CWA can become closer in line with the original goals. Peter Swanborn, in his book, *Case Study Research: What, Why, How?* discussed the advantages and disadvantages of case study research; there are many considerations with single case studies.[16] A case study is ideal for

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[13] *Id.*
[14] William Dunn, *Public Policy Analysis, Edition 5*, 4 (2016 Routledge).
[15] Coughlin,et al. at 15-32.
[16] Peter Swanborn, Case Study Research: What, Why, and How? 66 (Sage Publications., 1st ed. 2010).

investigation of a place with many complex systems at work.[17] Case study research involves intensive examination of a complex phenomenon.[18] A successful case study method develops a nuanced framework of understanding which is challenging in other methods or research with larger numbers of subjects.[19] This developed framework should be examined to help understand to what extent it is transferrable to other situations.[20] While the specific avenues for improvement in CWA implementation in the chosen site for the case study, Paradise Creek in Idaho and Washington, may not be transferrable, if the case study shows that changes in implementation under the existing law might lead to success in achieving water quality standards, then it suggests that similar detailed examinations in other watersheds my lead to success without resort to the politically difficult solution of amending the CWA to impose mandatory solutions.

[17] Swanborn, at 66-7.
[18] Swanborn, at 2.
[19] Swanborn, at 66-7.
[20] *Id*.

Chapter 2: the Clean Water Act of 1972

Stated Intent

The CWA was passed with the declared goal: "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[21] Courts trying to interpret a statute will attempt to do so in a manner that is consistent with the intent of Congress. The intent of the Congress is buttressed by the legislative history of the act, which is discussed later in this chapter. The CWA's "Congressional Declaration of Goals and Policy" is 33 U.S.C.A. § 1251, which lists specific goals for the legislation, subsection (a)(1) states the goal for elimination of discharge of pollutants into navigable water is the year 1985.[22] Subsection (a)(2) states that by July 1, 1983, water quality should be attained that provides for recreation and the propagation of "fish, shellfish and wildlife."[23]

Subsections give further elaboration to what constitutes "clean water." Subsection (a)(3) prohibits toxic pollutants at toxic levels.[24] The focus of this case study, nonpoint pollution, is covered by subsection (a)(7), which states "it is the national policy that programs for the control of nonpoint sources of pollution be developed and implemented in an expeditious manner so as to enable the goals of this chapter to be met through the control of both point and nonpoint sources of pollution."[25] Section (a)(4) and (a)(5) address waste water plants, providing funding and requiring pollutant management processes by wastewater plants, another issue examined in the case study.[26] Both the central statement of goals and the subsequent subsections have clear

[21] 33 U.S.C.A. § 1251(a).
[22] 33 U.S.C.A. § 1251 (a)(1).
[23] 33 U.S.C.A. § 1251 (a)(2).
[24] 33 U.S.C.A. § 1251 (a)(3).
[25] 33 U.S.C.A. § 1251 (a)(7).
[26] 33 U.S.C.A. § 1251(a)(4,5).

statements of intent. The text of the CWA is the most significant source for congressional intent, followed by the legislative history of Congress if the statute is ambiguous.

History of the CWA and other Federal Water Quality Law

Pre-CWA

There was significant federal water quality law before the creation of the CWA in 1972.[27] Federal power to regulate water quality is rooted in the United States' Constitution. [28] Article 1, Section 8, Clause 3, of the Constitution is known as the commerce clause, which gives congress the power to "[t]o regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes[.]"[29]

This section of the Constitution was interpreted by the 1824 Supreme Court Case, *Gibbons v. Ogden*.[30] The controversy in *Gibbons v. Ogden* revolved around a possible conflict between state and federal laws.[31] The New York State legislature had granted a steamboat company an exclusive, long-term license to operate. [32] This company then sold Mr. Ogden the license for the Hudson River steamboat crossing from New Jersey to New York City.[33] Mr. Gibbons was another operator from Elizabethtown, New Jersey, to the city. [34] Mr. Gibbons had a federal license to operate his boats, but no license from New York. When New York courts

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[27] Kenneth M. Murchison, *Learning from more than Five-And-A-Half Decades of Federal Water Pollution Control Legislation: Twenty Lessons for the Future*, 32 B.C. Envtl. Aff. L. Rev. 527, 527-37 (2005) (Federal Water Pollution Control Legislation in the United States: Regulation Prior to 1972).
[28] *Id.*
[29] U.S. Const. art. I, § 8.
[30] *Gibbons v. Ogden*, 22 U.S. 1, 1-70, (1824).
[31] *Id.*
[32] *Id.*
[33] *Id.*
[34] *Id.*

issued an injunction banning Mr. Ogden's boats from New York State waters, this was possibly a conflict of law between the exclusive state license and the federal license. [35]

This controversy required the Court to determine what exactly the Constitution meant by to "[t]o regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes[.]"[36] A narrow interpretation of "commerce" would probably not include passengers, it would just be goods in the most traditional sense. [37] However, a broad interpretation of the word "commerce" could include all types of transactions relating to business, which would include passengers, traveling to a center of business and other trade. [38]

A unanimous Court decided for Mr. Ogden, affirming the broad interpretation of the commerce clause. [39] The New York law was invalid due to the conflict with the federal law under the proper authority of the Constitution. [40] The Court defined commerce as "the exchange of one thing for another; the interchange of commodities; trade or traffic." [41] The Court continued that the federal government "has an incidental power, indeed, to regulate navigation, but only so far as that navigation is, or may be, subservient to the commerce it has a direct power to regulate." [42] The Court did qualify this incidental power by stating: "the Federal government can do no act on the navigable waters within the limits of the United States, which, or a corresponding act to which, it cannot do on the land, within the same limits." [43]

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[35] *Id.*
[36] *Gibbons v. Ogden*, 22 U.S. 1, 1-70, (1824);: and, U.S. Const. art. I, § 8.
[37] *Gibbons v. Ogden*
[38] *Id.*
[39] *Id.*
[40] *Id.*
[41] *Id.*
[42] *Id.*
[43] *Id.*

This interpretation of the commerce clause is a balance between federal and state authority which the Supreme Court noted "the navigable waters belong no more to the Federal government, and are not otherwise affected by the Union, than the land itself." [44] Therefore, both land and water "are equally subject to the jurisdiction of the [federal] government, for the exercise of all powers delegated to it by the Constitution, and both equally subject to State jurisdiction, for the exercise of all powers connected with State sovereignty." [45] New York law was forced to yield to federal rules due to the federal power over navigable waters; and the Court had created an incidental power over navigable waters. [46] *Gibbons v. Ogden* created the concept of "navigable waters" as at least partially federal domain.[47] The current definition of navigable waters can be found in Title 33 of the Code of Federal Regulations, Chapter 2, Part 329.4, which states:

> Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity.[48]

This definition reflects the 1824 Supreme Courts' conceptualization of the commerce clause and navigable waters.

Kenneth M. Murchison provides a history of water pollution in the United States in his law review article: *Learning from more than Five-And-A-Half Decades of Federal Water Pollution Control Legislation: Twenty Lessons for the Future*.[49] A significant federal statute

[44] *Id.*
[45] *Id.*
[46] *Id.*
[47] *Id.*
[48] 33 C.F.R. § 329.4
[49] Murchison, at 527-37.

from the late nineteenth century for the protection of water quality was the Rivers and Harbors Appropriation Act of 1899.[50] William L. Andreen also writes on the history water pollution in the United States in his article: *The Evolution of Water Pollution Control in the United States--State, Local, and Federal Efforts, 1789-1972: Part II,* where Andreen notes that four federal statutes for water quality preceded the Rivers and Harbors Appropriation Act.[51] These four statutes were codified in section 13 of Rivers and Harbors Appropriation Act.[52] Section 13 was known as the Refuse Act which "prohibited discharging refuse into navigable waters or their tributaries."[53]

The Refuse Act has two prohibitions with significant qualifications: first the Refuse Act "makes it unlawful to discharge 'any refuse matter' into navigable waters or their tributaries except for 'that flowing from streets and sewers and passing therefrom in a liquid state."[54] "Federal public works," or wastewater plants were explicitly included in this exemption as well.[55] The second limits polluters where navigation may be "impeded or obstructed," to deposit "'material of any kind ... on the bank of any navigable water, or on the bank of any tributary of any navigable water' when the material 'shall be liable to be washed into such navigable water.'"[56]

The Refuse Act was ambiguous as to what constituted refuse, Andreen comments that this made it unclear whether the Act was intended to create a broad national system of

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[50] Murchison, 527-37. *Citing:* Rivers and Harbors Appropriation Act of 1899, chCh. 425, 30 Stat. 1121 (codified as amended at 33 U.S.C. §§ 401-418 (2000)).
[51] William L. Andreen, *The Evolution of Water Pollution Control in the United States--State, Local, and Federal Efforts*, 1789-1972: Part II, 22 Stan. Envtl. L.J. 215, 220-23 (2003) (overview of the Rivers and Harbors Appropriation Act and subsequent implementation).
[52] *Id.*
[53] Murchison, 527-37. Citing 33 U.S.C.A. § 407.
[54] *Id.*
[55] *Id.*
[56] *Id.*

regulation or was just limited at specific obstructions in navigable waters.[57] From the implementation of the Refuse Act, until passage of new legislation in the mid twentieth century, the Army Corps of Engineers applied the Act only where discharge of material would limit navigation.[58] This meant solid materials were the only ones regulated, and suit was occasional.[59] The Refuse Act was the primary federal water quality law for the beginning of the twentieth century.

The Federal Water Pollution Control Act of 1948 was the first "modern federal legislation" for water pollution.[60] This earlier legislation codified the federal responsibility to assist states in water quality improvement with technical and financial assistance.[61] The federal government was in a secondary role, and "that water pollution control was primarily the responsibility of state and local governments."[62] Federal enforcement authority required consent of the offender and was limited to "a public nuisance action for interstate pollution that endangered persons" with a complicated process of notice and limited to recommendation, hearings and warnings as the extent of enforcement.[63]

In 1956, and in 1961, two amendments were passed that increased funding and added programs for municipal wastewater to the earlier legislation.[64] Enforcement was slightly expanded under the 1961 Act; federal officials could now offer enforcement help to municipalities, conditional on state consent.[65] The Water Quality Act of 1965 increased the

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[57] Andreen, at 220-23.
[58] *Id.*
[59] *Id.*
[60] Murchison, 527-37.
[61] *Id.*
[62] *Id.*
[63] *Id.*
[64] Murchison, 527-37; and, Water Pollution Control Act Amendments of 1956, Pub. L. No. 84-660, 70 Stat. 498.
[65] Murchison, 527-37.

enforcement power of the federal government.[66] It included mandates for states to establish standards for interstate water quality as well as prepare implementation plans for controlling pollution.[67] It created the Federal Water Pollution Control Administration which required submission of state plans.[68] Still no federal mandate for enforcement on individual sources was present, nor for enforcement of a federal plan, when state plans failed.[69]

The Clean Water Restoration Act of 1966 served to increase federal funding, including: increasing federal grants for waste treatment, additional support for research, more grants for state and local agencies, and other funding support for water quality improvement.[70]The Water Quality Improvement Act of 1970 was in response to two well publicized damaging oil spills; it established strict liability for oil spills.[71]

The Federal Water Pollution Control Act of 1948, its successor bills and Court rulings did little to curtail the growing water quality problems in the United States. [72] The two major sources of pollution just prior to the 1972 Act were diffuse runoff based pollution and municipal wastewater plants.[73]

The Supreme Court also took action, in 1960, decisions expanded federal control over water quality with two rulings.[74] In *United States v. Republic Steel Corp.* the Court limited an

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66 *Id.*
67 *Id.*
68 *Id.*
69 *Id.*
70 *Id.*
71 *Id.*; Note, Oil spills were at Torrey Canyon, Great Britain (1967), and Santa Barbara, California (1969).
72 *Id.*
73 *Id.*
74 *Id.*

exemption for liquid sewage discharges.[75] Six years later in *United States v. Standard Oil Co.*, the Court expanded upon the definition of "refuse" that was not permitted in navigable waters.[76]

Between October of 1969 and April 1970, multiple U.S. attorneys filed 66 actions against industrial polluters under the Rivers and Harbors Appropriation Act, with the Refuse Act provisions. [77] At this point, Andreen explains that "became clear that a real permit program, as envisioned by the Refuse Act, ought to be established since judicial enforcement would never make more than a dent in the large number of polluters that needed attention."[78] The Supreme Court's broad interpretation of the Refuse Act "helped to make possible the compromise" that led to the passage of the 1972 legislation.[79]

1972 Legislation and Legislative History of the Act

The Senate

In 1970, the Senate began to re-work the patchwork approach to federal water quality legislation into a coherent new bill; 12 proposals were heard that year although efforts were ultimately shelved to focus on the Clean Air Act.[80] Water protection legislation talks were resumed in 1971, public demand for clean water was high.[81] The 1971 legislation was introduced by Senator Edmund S. Muskie, a Maine democrat and ardent environmentalist.[82]

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[75] Murchison, 527-37; Citing *United States v. Republic Steel Corp.*, 362 U.S. 482, 485 (1960).
[76] Murchison, 527-37; Citing *United States v. Standard Oil Co.*, 384 U.S. 224 (1966).
[77] Andreen, at 258-60. (Rediscovery of Rivers and Harbors Appropriation Act).
[78] *Id.*
[79] Murchison, 536-51. (Principal Aspects of the Legislation).
[80] Andreen, at 260-86. (Legislative History of the 1972 Clean Water Act).
[81] *Id.*
[82] Andreen, at 260-86; and, R. W. Apple Jr., *Edmund S. Muskie, 81, Dies; Maine Senator and a Power on the National Scene*, N.Y. Times, March 27, 1996.

The 1971 Muskie proposal included revamping of the current system of regulation and enforcement with a considerable gain in federal power.[83] New regulations would require states' enactment of water quality standards for all navigable waters, as well as the tributaries.[84] Under the Water Quality Act of 1965 only interstate waters were covered, this included intrastate and interstate waters, this was a significant expansion.[85] Environmentalists wanted this expansion.[86]

These new water quality standards were to be submitted to and approved by the EPA; proposed implementation plans were required which would bring waterbodies into compliance within three years.[87] The EPA would be required to catalog the new technology, and new installers would have been required to use the "latest available pollution control techniques."[88] Enforcement power was significantly increased under the 1971 proposal, Senator Muskie described the current enforcement as "spotty" and "tougher enforcement" was necessary.[89] EPA would be allowed to sue civilly or issue a compliance order as a response for violations of water quality standards or implementation plans.[90] Again, environmental groups were the impetus for the concerns of lax enforcement.[91] A broad citizen suit provision was included; EPA enforcement was subject to judicial review.[92] Citizen suit provisions allow for citizens to have

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[83] Andreen, at 260-86; Citing S. 523, 92d Cong. (1971), reprinted in Water Pollution Control Legislation, Pt. 1: Hearings Before the Subcomm. on Air and Water Pollution of the Senate Comm. on Public Works, 92d Cong. 193-240 (1971).
[84] *Id.*
[85] *Id.*
[86] Murchison, at 536-51.
[87] Andreen, at 260-86; Citing Senate Hearings 1971, Pt 1.
[88] *Id.*
[89] *Id.*
[90] *Id.*
[91] Murchison, at 536-51.
[92] Andreen, at 260-86; Citing, Senate Hearings 1971, Pt 1.

standing to sue, without having to separately prove standing.[93] This allows concerned citizens to enforce the law in absence of governmental enforcement.[94]

In February of 1971, another bill was introduced with the support of the Nixon administration, by Senator John Sherman Cooper, a liberal Kentucky republican.[95] This bill mirrored many aspects of Senator Muskie's bill, it had a more limited citizen suit power, smaller appropriations, and some other small differences.[96] The differences were minor enough for Andreen to characterize this bill as a "clone [to] Muskie's, with just a bit less stringency and a bit less certainty."[97]

The following month in March of 1971, two bills headed to the Senate Committee on Public Works began hearings in the Subcommittee on Air and Water Pollution. [98] The Subcommittee on Air and Water Pollution created draft of the bill released in July 1971.[99] The draft's release increased tensions between environmentalist and industry.[100] Additionally, the new draft legislation required an EPA permit before a discharge was legal, and no longer had the exception for public wastewater plants.[101] The draft mirrored Senator Muskie's more expansive designs for citizen's suit and appropriations provisions, rather than Cooper's similar but less ambitious provisions.[102] Industry was particularly opposed to a national minimum water

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[93] Jeffrey G. Miller, *Theme and Variations in Statutory Preclusions Against Successive Environmental Enforcement Actions by EPA and Citizens: Part One: Statutory Bars In Citizen Suit Provisions*, 28 Harv. Envtl. L. Rev. 401 (2004).
[94] *Id.*
[95] Andreen, at 260-86; Citing, Senate Hearings 1971, Pt 1; And, Albin Krebs, *John Sherman Cooper Dies at 89; Longtime Senator from Kentucky*, N.Y. Times, February 23, 1991.
[96] Andreen, at 260-86; Citing, Senate Hearings 1971, Pt 1.
[97] *Id.*
[98] Andreen, at 260-86; Citing, John Quarles, *Cleaning Up America: An Insider's View of the Environmental Protection Agency* 20-21 (1976).
[99] *Id.*
[100] *Id.*
[101] *Id.*
[102] Andreen, at 260-86.

quality standard of “fishable swimmable”; which is a level able to support indigenous populations of fish and be clean enough to be used as recreational.[103] This was to be achieved by 1980, a timeline that was seen as overly onerous.[104] Technology requirements were deemed cost prohibitive by industry.[105]

In August 1971, the subcommittee sent the bill to the full committee where a revised version was unanimously approved.[106] The committee found the “lagging” states were part of a water quality effort that was “inadequate in every vital aspect.”[107] Murchison notes that industry was in favor of the permit system so as to reduce possible liability under the Refuse Act, which had strong language, and a new broad interpretation by the Court.[108] Andreen explains, a permit system allowed for effective implementation by giving polluters firm limits, since “‘[w]ater quality standards… often [could not] be translated into effluent limitations-- defendable in court tests, because of the imprecision of models for water quality and the effects of effluents in most waters.’”[109] Best available technology and enforcement were emphasized in the new prospective bill in the Senate Committee.[110]

Municipal sewage plants nationwide were particularly problematic and polluters faced “an almost total lack of enforcement.”[111] Due to this many of the United States’ waters were “severely polluted” and “unfit for most purposes.”[112] Environmentalists sought the elimination

[103] Andreen, at 260-86; Citing, Quarles at 149.
[104] *Id.*
[105] *Id.*
[106] Andreen, at 260-86; Citing, S. Rep. No. 92-414, 92d Cong. 92 (1971), reprinted in- A Legislative History of the Water Pollution Control Act Amendments of 1972 1509 (1973) [hereinafter Leg. Hist. 1972 1 and 2].
[107] *Id.*
[108] Murchison, 536-51.
[109] Leg. Hist. 1972; And, Andreen, at 260-86.
[110] *Id.*
[111] *Id.*
[112] *Id.*

of the municipal sewage exception, a source of much of their ire.[113] With promises of large appropriations to improve municipal wastewater facilities, the support of many local governments, and their representatives, was gained.[114]

The House

In the House of Representatives over two hundred separate bills relating to water quality were introduced in 1971.[115] This meant little was done compared to the swift acting Senate, which approved the committee bill on November 2, 1971.[116] The Nixon Administration wanted further hearings before the House Public Works Committee due to concerns of: expanded federal authority, strict new standards on industry and increased appropriations.[117]

On November 19, 1971, the entire Public Works Committee of the House co-sponsored a new bill, that was "remarkably similar to the Senate bill," as a means of reopening the hearings, and addressing the administration's and industry's concerns.[118]

In the second round of House hearings opponents of the proposal criticized the bill, particularly technology based water quality standards, which allegedly disrupted necessary balancing of environmental needs with economic needs which occurred in the standards based on use and habitat.[119] The Administration encouraged creation of 30-day notice periods in various enforcement provisions of the bill, under the thought it would limit conflict between the state and the EPA.[120]

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[113] Murchison, at 536-51.
[114] *Id.*
[115] Andreen, at 260-86.
[116] *Id.*
[117] Andreen, at 260-86; Citing, Quarles at 149.
[118] H.R. 11,896, 92d Cong. (1971).
[119] Andreen, at 260-86; Citing, H.R. 11,896, 92d Cong. (1971) [hereinafter H.R. 11,896], reprinted in Water Pollution Control Legislation, 1971: Hearings Before the House Comm. on Public Works, House of Rep., on H.R. 11,896 and H.R. 11,895, 92d Cong. (1971).
[120] Andreen, at 260-86.

The full bill was reported to the House on March 11, 1972. Andreen notes the House "was not eager to abandon water quality standards as a regulatory instrument" and extremely nervous about the costs of technology in a technology based system.[121] The technology based provision was "watered down" and the House committee used a permit based system to implement water quality standards, as well as, effluent limitations.[122] States were still required to promulgate water quality standards, yet some modifications were made: all waters were subject to standards, standards were reviewed every three years, and a three step process was instituted.[123] The three step plan "required states: (1) to identify waters that were not meeting standards after the application [of] effluent limitations; (2) to set a 'total maximum daily loads designed to get those streams into compliance; and (3) to establish a 'continuing planning process.'"[124] A total maximum daily load (TMDL) is a limit of the level of the pollutant allowed in a waterbody, usually measured by concentration.[125] This represented a strengthening of the water quality standards program and protection against disbursed pollutants.[126]

However, the House Committee had also weakened the legislation in numerous ways: adding a waiver provision for the water Quality standards, a clause requiring a separate congressional reauthorization for 1981 deadlines, a separate program for thermal discharges, a separate program for Army Corps for dredging, and delegation of individual discharge permit approval to state agencies.[127] The EPA's veto power over permit approval at the state level remained.[128] Enforcement was similar to the senate bill, with some mandatory enforcement

[121] *Id.*
[122] 2 Leg. Hist. 1972, And, Andreen, at 260-86.
[123] *Id.*
[124] *Id.*
[125] 33 U.S.C. § 1313 (d)(1)(c)
[126] Andreen, at 260-86.
[127] 2 Leg. Hist. 1972, And, Andreen, at 260-86.
[128] *Id.*

turned discretionary.[129] The House Committee also limited the citizen's suit provision by restricting standing with a define term for citizen.[130]

On March 29, 1972 the House passed bill 380 to 14.[131] Environmentalists were dismayed due to the whittled down nature of the bill; conversely the Nixon Administration was dismayed at the final size of the appropriation involved.[132] The EPA was "anxious" about the condition of the water and the lack of action due the pending legislation. General enforcement was stalled and industry was waiting to see legislation before investing in infrastructure.[133] A conference committee would attempt to resolve the differences between the house and senate bills.[134]

Conference Committee

The Conference Committee met for four months, and thirty nine separate meetings in the summer of 1972, reaching agreement in late September.[135] The conference bill was full of compromises between the two different versions[136]. The central pollution control was a permitting system from the Senate bill, the National Pollutant Discharge Elimination System (NPDES), discussed earlier. The NPDES was covered in section 301(a) of the new legislation.[137]

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[129] *Id.*
[130] *Id.*
[131] Andreen, at 260-86.
[132] Andreen, at 260-86; Citing, Quarles at 156.
[133] *Id.*
[134] Andreen, at 260-86.
[135] Andreen, at 260-86; Citing, S. Rep. No. 92-1236, 92d Cong. 99 (1972), reprinted in 1 Leg. Hist. 1972, supra note 337, at 282.
[136] Andreen, at 260-86.
[137] Murchison, at 536-51.

The Conference Committee applied the legislation to the "waters of the United States," more expansive than the alternative navigable waters.[138] Andreen notes "In doing so, the conference declared that it "fully intend[ed]" to give the term "the broadest possible constitutional interpretation.'"[139] This broad scope was a victory for the environmentalists.[140]

States could gain delegated permitting authority under NPDES; EPA did not have to individually approve permits, but retained a veto to enforce the Act, a significant concession to the House version.[141] The Senate approach to effluent limitations was adopted, with significant alterations: the multiple deadlines were extended for: technology, secondary sewage treatment, and "no discharge" deadlines.[142] The "no discharge" goal was retained from the Refuse Act, in the form of the 1985 "national goal."[143] No discharge mandates were set aside for limits based on technological capacity alone, and to include economic considerations, "unless the elimination of all discharges became technologically and economically achievable."[144]

The water quality standards program would have triennial reviews, TMDLs, and other continuous obligations.[145] The EPA was responsible for creation of federal effluent standards, and enforcement of the standards.[146] Farming interests supported the bill because the focus on point sources which do not include disbursed sources and by definition do not include agriculture would have limited impact on operations.[147] Senator Muskie was worried that the

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138 Andreen, at 260-86.
139 S. Rep. No. 92-1236, 92d Cong. 144 (1972), reprinted in 1 Leg. Hist. 1972, supra note 337, at 327; and, Andreen, at 260-86.
140 Murchison, at 536-51.
141 Pub. L. No. 92-500, § 402(d)(2), reprinted in 1 Leg. Hist. 1972, supra note 337, at 69; and, Andreen, at 260-86.
142 *Id.*
143 Murchison, at 536-51.
144 Pub. L. No. 92-500, § 301(b)(2), reprinted in 1 Leg. Hist. 1972, supra note 337, at 32; and, Andreen, at 260-86.
145 *Id.*
146 Murchison, at 536-51.
147 *Id.*

water quality plan, with substantive obligations, would distract from the technology driven aspects of the 1972 bill.[148] The Conference Committee adopted House's weaker version of enforcement, this version had some civil enforcement as discretionary.[149] Environmental proponents, including Senator Muskie felt discretionary enforcement compromise was acceptable due to mandatory duties to issue abatement orders.[150] It was expected by Senator Muskie that the administrator had a duty to investigate and issue violations where they have reason to believe they have occurred. [151]

The Conference Committee went with the Senate's version of the Citizen's Suit provision in which "citizen" was widely defined, a reflection of the recent Supreme Court decision, *Sierra Club v. Morton.*[152] *Sierra Club v. Morton* was a Supreme Court case which decided members of an environmental organization did not have sufficient standing to sue to oppose a proposed skiing development on Forest Service land.[153] Standing is a common law legal concept requiring involvement or other significant relationship to a controversy before one is allowed to sustain a suit. [154] The proposed conference committee citizens' suit provision was limited by a notice requirement, a citizen had to provide 60 days of notice before suing.[155] Citizen suits are discussed in depth later in this chapter. Finally, 18 billion dollars were authorized to be spent over the next three years.[156]

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[148] Andreen, at 260-86; Citing, Pub. L. No. 92-500, § 402(a)(1), (b)(1)(A), reprinted in 1 Leg. Hist. 1972, supra note 337, at 67-68.
[149] 1 Leg. Hist. 1972, supra note 337, at 174; And, Andreen, at 260-86.
[150] *Id.*
[151] *Id.*
[152] Pub. L. No. 92-500, § 505(g), reprinted in 1 Leg. Hist. 1972, supra note 337, at 76; And, Andreen, at 260-86.
[153] *Sierra Club v. Morton*, 405 U.S. 727 (1972).
[154] *Id.*
[155] Murchison, at 536-51.
[156] Pub. L. No. 92-500, § 207, reprinted in 1 Leg. Hist. 1972, supra note 337, at 26; and, Andreen, at 260-86;

Approval

Conference Committee bill was put up to vote; the Senate passed the bill 74 in favor with none opposed.[157] The same day the House approved it with 366 for and 11 against.[158] President Nixon was opposed to amount of spending in the bill, so he vetoed it on October 17, 1972.[159] The override was accomplished in the senate later that day, 52 to 12.[160] The next day, October 18, 1972, the House overrode, 247 to 12, the Clean Water Act of 1972 was enacted.[161]

Amendments after the Passage of the CWA

Clean Water Act of 1977

The Clean Water Act of 1977 was to function as an amendment to the 1972 framework, Congress attempted to fix water problems that were persisting after the 1972 legislation. [162] There were new requirement for state waste management plans for "all wastes generated" specifically naming nonpoint sources as needing identified with "procedures and methods put forth to "to control to the extent feasible such sources."[163] A Rural Clean Water Program consisted of several unpublished regulations, but the program was never funded and later expired.[164] Some funding was to be used to pay farmers 50% for implementation of best management practices.[165] This attempt to create federal mandated state management was indicative of some congressional desire to control nonpoint sources in 1977.

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[157] 1 Leg. Hist. 1972, supra note 337, at 222-23; and, Andreen, at 260-86.
[158] 1 Leg. Hist. 1972, supra note 337, at 276-79; and, Andreen, at 260-86.
[159] 1 Leg. Hist. 1972, supra note 337, at 137-39; and, Andreen, at 260-86.
[160] 1 Leg. Hist. 1972, supra note 337, at 135-36; Andreen, at 260-86.
[161] 1 Leg. Hist. 1972, supra note 337, at 109-13; and, Andreen, at 260-86.
[162] Mary E. Christopher, *Time to Bite The Bullet: A Look at State Implementation of Total Maximum Daily Loads (Tmdls) Under Section 303(D) of The Clean Water Act* , 40 Washburn L. J. 480, 502-06 (2001)). (1977 and 1987 Amendments).
[163] *Id.*
[164] *Id.*
[165] Murchison, at 560.

National Resources Defense Council, Inc. v. Costle, 1977 federal court decision, invalidated "an EPA regulation that excluded irrigation return flows from the permit requirements."[166] The 1977 legislation reversed this by "excluding irrigation return flows from the definition of point sources."[167] The 1977 Act also extended deadlines for the best available technology improvements to 1987.[168]

Municipal Wastewater Treatment Construction Grant Amendments of 1981

The Municipal Wastewater Treatment Construction Grant Amendments of 1981 were passed four years later.[169] This legislation centered on correcting aspects of the appropriations for public works, although some other significant changes were made.[170] The appropriations needed re-authorization, at the same time the Congress reduced the percentage of federal assistance for most grant types.[171]

The Amendments "weakened and diluted the feasibility-based standards of the 1972 and 1977 legislation, while making modest improvements in the water quality standards."[172] Many feasibility and other technology standards were weakened by adding waivers or extending deadlines.[173] A revision of state water quality standards was mandated, but that was not extended to TMDLs.[174]

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[166] Murchison, at 559; Citing, *National Resources Defense Council, Inc. v. Costle,* 568 F.2d 1369, 1379 (D.C. Cir. 1977).
[167] *Id.*
[168] Murchison, at 560.
[169] Murchison, at 564-6.
[170] *Id.*
[171] *Id.*
[172] *Id.*
[173] *Id.*
[174] *Id.*

Water Quality Act of 1987

The Water Quality Act of 1987 again addressed multiple aspects of the legislation.[175] This Act strengthened the law against some toxic chemicals and increased nonpoint source protection.[176] There were also limitations on storm water runoff and some expanded enforcement.[177] Appropriation was replaced with a loan program for public works. Feasibility plans had deadlines further extended.[178]

Non point programs were to "be 'developed and implemented in an expeditious manner so as to enable the goals of [the Clean Water Act] to be met through the control of both point and nonpoint sources of pollution.'"[179] Additionally, States were required to "identify waters which cannot reasonably be expected to achieve state ambient water quality standards "without additional action to control nonpoint sources of pollution" [180] In the advent of a "cannot reasonably be expected to achieve" finding, the 1987 amendments required states to "describe a process for identifying 'best management practices' and other measures for reducing nonpoint source pollution[,]" as well as, identifying state and local programs for controlling nonpoint pollution. [181] Nonpoint pollution and best management practices will be further defined later in this chapter. Nonpoint sources are essentially any diffuse source of pollution, such as agricultural or urban storm runoff.[182] Best management practices are efforts made to prevent or

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[175] *Id.*
[176] Michael M. Wenig, *How "Total" Are "Total Maximum Daily Loads" ?--Legal Issues Regarding the Scope of Watershed-Based Pollution Control Under the Clean Water Act*, 12 Tul. Envtl. L.J. 87, 101 (1998). (1987 Amendments).
[177] Murchison, at 564-6.
[178] *Id.*
[179] Wenig, at 101.
[180] *Id.*
[181] *Id.*
[182] EPA, *Learn about Effluent Guidelines* (April, 16 2016), http://www.epa.gov/eg/learn-about-effluent-guidelines.

control the discharge of pollutants.[183] Finally, the state or the EPA establishes programs and disburses grants for this implementation of these controls. The 1987 amendments are indicative the failure of the 1972 CWA to clean up nonpoint source pollution through failure of both management and funding. [184]

Structure of CWA

Cooperative Federalism

The CWA is a federal law that utilizes the principle of cooperative federalism to implement the law. Black's Law dictionary defines cooperative federalism as "Distribution of power between the federal government and the states in which each recognizes the powers of the other while jointly engaging in certain government functions."[185] The CWA fits relatively neatly into this definition. The federal government's duties under the CWA are administered by the EPA. It is the EPA's ultimate responsibility to see the CWA implemented, yet the EPA utilizes state agencies for many aspects of CWA implementation.

In Bonnie Malloy's, *Testing Cooperative Federalism: Water Quality Standards under the Clean Water Act*, she writes the Act is reliant on cooperative federalism to achieve its goals.[186] The design of CWA power is delegated to a State as long as the State complies with minimum standards.[187] This power sharing combines the advantage of a federal protection with state significant freedom for flexibility. [188] An overly centralized system would lose lots of local

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[183] 33 U.S.C.A. § 1311 and, EPA, *Learn about Effluent Guidelines*.
[184] Wenig, at 101.
[185] Blacks Law Dictionary, 687, (Bryan A. Garner eds., nineth ed. 2009).
[186] Bonnie A. Malloy, *Testing Cooperative Federalism: Water Quality Standards Under the Clean Water Act*, 6 Envt'l & Energy L. & Pol'y J. 63, 101-02(2011). (Malloy's conclusions about the effectiveness of cooperative federalism).
[187] *Id.*
[188] Malloy, at 86-90. (Benefits of Cooperative Federalism).

expertise.[189] The federal program preserves economies of scale for data collection, research and funding, avoiding duplicative action and ensuring quality science for all states.[190]

Federal legislation would prevent corporations from locating in a state with the weakest protections by setting national standards over ineffective environmental legislation of most states.[191] This prevents economic incentives for states to compete for development by having less regulation than other states often referred to as a "race to the bottom".[192] This also recognized the fundamentally inter-state nature of the nation's rivers and national goals of the CWA.[193] Using a federal floor allows states to set higher standards should they wish, another way that a locality can take a customized approach should they desire cleaner water.[194]

Shana Campbell Jones discusses a new aspect of cooperative collaboration in management, in her work *Making Regional and Local TMDLs Work: the Chesapeake Bay TMDL and Lessons from the Lynnhaven River*; nongovernmental groups became full partners with localities, the state, and the federal government, as a part of efforts to meet a bacteria TMDL.[195] In this case, governmental officials acknowledged the nongovernmental partners "played an important role in building trust and educating citizens while communicating that the meaning and significance of the federal regulations" and their collaborations "will be necessary for continued progress."[196] A broad citizen's suit provision eliminated process of proving

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189 *Id.*
190 *Id.*
191 Dianne K. Conway, *TMDL Litigation: So Now What?,* 17 Va. Envtl. L.J. 83, 85-86 (1997).
192 Malloy, at 86-90.
193 Conway, at 85-86.
194 Malloy, 86-90.
195 Shana Campbell Jones, *Making Regional and Local TMDLs Work: the Chesapeake Bay TMDL and Lessons from the Lynnhaven River,* 38 Wm. & Mary Envtl. L. & Pol'y Rev. 277, 315-16 (2014).
196 Campbell Jones, at 315-16.

standing, a necessary element of a lawsuit, effectively resulting in one less legal hurdle for successful suits under the CWA.

Malloy describes litigation as an example of "imperfect but effective cooperative federalism in practice."[197] It is a slow correction, but it is the checks and balances at work.[198] She supports consistent federal enforcement of state inaction 'to ensure sustainability of the nation's waters."[199] For these reasons, the CWA allows for state agencies to administer large aspects of the duties of the law. However, EPA retains the ultimate responsibility for enforcement of the CWA.

Point or Nonpoint Sources

The CWA separates water pollution into two types of pollution; point source and nonpoint source. [200] Point sources are covered under 33 U.S.C.A. § 1311, titled "Effluent Limitations[,]" also known as the NDPES.[201] Point sources are defined as:

> point source means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture.[202]

The definition of a nonpoint source is related to the definition of point sources, according to the EPA, everything that is not a point source is a nonpoint source.[203] In the initial drafting of the

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[197] Malloy, at 101-102.
[198] Malloy, at 101-102.
[199] Malloy, at 101-102.
[200] *Idaho Sportsman's Coalition v. Browner*, 951 F.Supp. 962, 965 (W.D. Wash. 1995). at 965.
[201] 33 U.S.C.A. § 1311.
[202] EPA, *Clean Water Act, Section 502 General Definitions* (April 16, 2016), https://www.epa.gov/cwa-404/clean-water-act-section-502-general-definitions.
[203] EPA, *What is a Nonpoint Source?* (April 16, 2016), http://www.epa.gov/polluted-runoff-nonpoint-source-pollution/what-nonpoint-source.

CWA, the distinction between nonpoint and point sources was made vital to water quality programs nationwide.[204]

33 U.S.C.A. § 1329 is titled "Nonpoint source management programs" it begins with a list of requirements for state governors.[205] The state governor needs to prepare a report for state review that "(B) identifies those categories and subcategories of nonpoint sources or, where appropriate, particular nonpoint sources which add significant pollution to each portion of the navigable waters identified under subparagraph (A) in amounts which contribute to such portion not meeting such water quality standards or such goals and requirements;"[206]

The logic in this distinction was that point sources are less abstract physically and thus more easily regulated. [207] The NPDES regulates point source permitting.[208] Focusing on the more tangible pollution sources allowed for quicker addressing of pollution problems.[209] Point sources were larger issue than nonpoint sources when the CWA was passed in 1972, municipal treatment plants in particular were a big problem.[210]

Setting Water Quality Standards

Setting water quality standards is a two-step process; it is a cooperative effort of the state agencies and the EPA, with the states taking the lead.[211] 33 U.S.C.A. § 1329 (A) states that State Governors "shall" protect state water in the following manner, after notice and public comment, Governors will submit to the EPA for approval reports that "identif[y] those navigable waters within the State which, without additional action to control nonpoint sources

[204] Conway, at 85-86.
[205] 33 U.S.C.A. § 1329
[206] *Id.*
[207] Conway, at 85-86.
[208] *Id.*
[209] *Id.*
[210] Andreen, at 260.
[211] Malloy, at 72-75. (The Operation of Water Quality Standards).

of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or the goals[.]"[212] The best scientific information is utilized in developing the criteria.[213] First, the state designates uses for each waterbody, such as protection of fish or recreation.[214]

Next, the state establishes water quality standards for implementing the designated uses, state have discretion but must comply with federal standards and guidelines.[215] Standards can be quantitative or qualitative, which are known as narrative standards.[216] Guideline can also be general considerations such as: public health, water supplies, fish, wildlife, agricultural, industrial, and navigation.[217] EPA provides expertise on what standards provide certain parameters, as well as a minimum.[218] Then the state identifies the waters not attaining their designated use on what is known as the 303(d) list.[219]

Water Quality Limited Segments and 303(d) List

The regulations for nonpoint sources are found in 40 C.F.R. § 130.7 titled; "Total Maximum Daily Loads and Individual Water Quality-Based Effluent Limitations."[220] This is known as the 303(d) program, which is pursuant to U.S.C.A. § 1251 (a)(7).[221] Subsections require states to assemble a prioritized list of Water Quality Limited Segments (WQLS) that may require TMDLs while "taking into account the severity of the pollution and the uses to be

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[212] 33 U.S.C.A. § 1329
[213] Malloy, at 72-75.
[214] *Id.*
[215] *Id.*
[216] *Id.*
[217] *Id.*
[218] *Id.*
[219] *Id.*
[220] 40 C.F.R. § 130.7.
[221] EPA, *Overview of Impaired Waters and Total Maximum Daily Loads Program*, (April 16, 2016), http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/intro.cfm#tmdlfitcwa.

made of such waters.[222] Nationally 42,457 waters are currently listed as impaired, mostly due to nonpoint pollution.[223]

Accounting for severity of the pollution and usage of the water is accomplished by "identifying the pollutants causing or expected to cause violations of the applicable water quality standards[,]" which requires sampling of all waterbodies. [224] WQLSs are bodies of water which "are not expected to attain applicable water quality standards."[225] Once a WQLS list is submitted the regulations give the EPA has thirty days to approve or disapprove.[226] If the EPA disapproves, it has 30 days to identify and list the waters as needed.[227]

As mentioned earlier, TMDLs are defined as the maximum amount of a specific pollutant that can be in the water each day, from all sources.[228] Setting a TMDL is a long process, Idaho's process and the Paradise Creek's 1997 TMDL are discussed in depth later. The first TMDLs were due on June 26, 1979.[229] Many states had not met that goal, and this resulted in lawsuits against those states.[230]

Best Management Practices

Below the requirement to list water quality standards, 33 U.S.C.A. § 1329 it states that state governors "shall" prepare reports for the EPA which:

> (C) describes the process, including intergovernmental coordination and public participation, for identifying best management practices and measures to control each category and subcategory of nonpoint sources and, where appropriate, particular

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[222] 40 C.F.R. § 130.7 (b)(1-4).
[223] EPA, National Summary of Impaired Waters and TMDL Information, accessed (5/20/16), https://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T
[224] *Idaho Sportsman's Coalition v. Browner*, 951 F.Supp. 962, 965 (W.D. Wash. 1995).
[225] *Idaho Sportsman's Coalition,* at 967.
[226] *Id*.
[227] *Idaho Sportsman's Coalition,* at 967.
[228]33 U.S.C. § 1313 (d)(1)(c)
[229] *Idaho Sportsman's Coalition,* at 965.
[230] *Idaho Sportsman's Coalition; Friends of the Wild Swan, Inc. v. U.S. E.P.A.,* 130 F.Supp.2d 1184 (D. Montana 1999); And, *Sierra Club v. Hankinson*, 939 F.Supp. 865, (N.D. Georgia 1996).

> nonpoint sources identified under subparagraph (B) and to reduce, to the maximum extent practicable, the level of pollution resulting from such category, subcategory, or source; and
>
> (D) identifies and describes State and local programs for controlling pollution added from nonpoint sources to, and improving the quality of, each such portion of the navigable waters, including but not limited to those programs which are receiving Federal assistance under subsections (h) and (i) of this section. [231]

This is the beginning of the specific management plans and the best management practices that often constitute portions of the nonpoint source pollution management plans; the rules further delineate specifics needed.[232]

Governors have six general requirements, three of which are important here.[233] First, identification of Best Management Practices (BMPs) and "measures which will be undertaken" resulting from the classification of sources required by the nonpoint provision in 33 U.S.C.A. § 1329 (1)(B).[234] Second, identification of programs to implement the BMPs is needed.[235] Third, a timeline "containing annual milestones" is mandated for implementation "at the earliest practicable date."[236]

Citizen Suits

The CWA has enforcement provisions for citizen initiated lawsuits for declaratory and injunctive relief under 33 U.S.C.A. § 1365(a), which specifically authorizes the citizens to bring suit for noncompliance with the CWA by stating; "any citizen may commence a civil action on his own behalf."[237] The legislative history described earlier showed two versions of this

[231] 33 U.S.C.A. § 1329
[232] *Id.*
[233] *Id.*
[234] *Id.*
[235] *Id.*
[236] *Id.*
[237] 33 U.S.C.A. § 1365(a).

provision, and the subsequent decision of Congress.[238] The House of Representatives' version of the citizen's suit language limited standing in various ways.[239] The Senate version was enacted in the law; it was more expansive allowing broad standing, reflective of the legislature's rejection of the Supreme Court's ruling in *Sierra Club v. Morton*.[240] The inclusion of this citizen's suit provision strongly indicates the Congress intended there to be methods available to all citizens to force enforcement of water quality protections. This allows most discretionary decisions made by the EPA regarding the CWA to be judicially reviewed, an important safeguard, considered heavily by Congress during drafting.[241]

TMDL Implementation

States develop their own processes for establishing TMDLs within the general framework of the requirements of the CWA. Idaho's process for implementing water quality standards, designated uses, and TMDLs will be explained. In Idaho, setting water quality standards, designated uses, 303(d) listing and implementation is accomplished by Basin Advisory Groups (BAGs) and Watershed Advisory Groups (WAGs). [242]

Idaho's Implementation Process

BAGs recommend water quality objectives for each of Idaho's six river basins. Paradise Creek is part of the Clearwater BAG, based out of Lewiston.[243] These groups have an assortment of duties such as: prioritization for monitoring, revising designated uses for water

[238] Andreen, at 260-86.
[239] *Id.*
[240] *Id.*
[241] *Id.*
[242] Idaho Department of Environmental Quality, *Total Maximum Daily Loads (TMDLs): Water Quality Improvement Plans*, accessed (5/1/16), http://www.deq.idaho.gov/water-quality/surface-water/tmdls/.
[243] Idaho Department of Environmental Quality, *Basin Advisory Groups*, accessed (5/1/16) from http://www.deq.idaho.gov/water-quality/surface-water/tmdls/basin-advisory-groups/.

bodies, categorizing water bodies, general framework for TMDL implementation processes, prioritization of water quality programs and appointing WAG members for specific watersheds within the basin.[244]

WAGs are community level organizations that allow interested citizens to be involved in water quality planning.[245] WAGs' primary responsibilities include: advising TMDL formation on community concerns such as: helping watershed education for water quality issues, identifying pollution sources, assisting development of an implementation plan and other actions needed. Idaho divided TMDL implementation into three steps: sub-basin assessment, loading analysis, and implementation.[246]

Each of the three steps in Idaho's TMDL process has a separate goal.[247] The goal of a Sub-Basin Assessment is to sufficiently understand the relevant water quality, the relationship of the water quality to its surroundings ultimately to identify problem pollutants which need TMDLs.[248] Loading Analysis is the second step of TMDL development in the State of Idaho; it is a complex scientific assessment which produces an estimate of pollutant load capacity with a margin of safety, and specific allocations to related pollutant sources.[249] The third step, implementation, requires plan specific information, such as the time frame for goal achievement, voluntary BMPs, specific schedules of actions to take place, the responsible

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[244] *Id.*
[245] Idaho Department of Environmental Quality, *Watershed Advisory Groups*, accessed (5/1/16) from http://www.deq.idaho.gov/water-quality/surface-water/tmdls/watershed-advisory-groups/.
[246] Idaho Department of Environmental Quality, *Guidance for Development of Total Maximum Daily Loads*, 7, (June 1999).
[247] *Id.*
[248] *Id.*
[249] *Id.*

agency, necessary documentation, follow-up regarding data gaps, and the actual measurements of the pollutant in the water.[250]

Sub Basin Assessment and Loading Analysis in Idaho

Sub-basin assessment is the first step of any Idaho TMDL.[251] This step includes initial documentation; it requires the description of "the water quality concerns and status of designated uses of individual water bodies, nature and location of pollution sources, and a summary of past and ongoing pollution control activities."[252] Sub-basin assessment is sometimes practically included as part of the second step, which is known as loading analysis.[253]

Before deciding if it is necessary to create a water quality sampling regime for a specific water body, it is necessary to sufficiently describe the relevant water quality, by examining what is known and unknown.[254] Once understanding improved, then problem pollutants can be identified.[255] TMDLs can then be set for pollutants in excess of the accepted load, and implementation plans begin.[256]

A watershed based approach accounts for both point sources and nonpoint sources; this allows water quality to be analyzed in full.[257] Once the water body is analyzed in full for the specific designated uses in question, pollutants which are greater than allowable standards and their causes are identified.[258] If background levels of naturally occurring pollutants that is taken

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[250] *Id.*
[251] Guidance for Development of Total Maximum Daily Loads, at 9.
[252] *Id.*
[253] *Id.*
[254] Guidance for Development of Total Maximum Daily Loads, 1-2.
[255] *Id.*
[256] *Id.*
[257] *Id.*
[258] *Id.*

in to account for the total load analysis.[259] According to the State of Idaho, designated uses are defined as "those uses assigned to waters as identified in the rules of the department whether or not the uses are being attained."[260] Designated uses recognized by the Idaho Department of Environmental Quality (DEQ) include: recreation, water supply, cold water biota (aquatic life), agriculture.[261]

Significant data is involved in the loading analysis of a particular water body. Implementation plans rely on scientific understanding of nature to help remediate wrongs. The margin of error due to lack of data has to be included in the final TMDL, which pose complicated problems. Science is integral in determining the most efficient or the best methods of monitoring an individual streambed.

Idaho loading analysis is an assessment which produces "an estimate of a water body's pollutant load capacity, a margin of safety, and allocations of load to pollutant sources defined as the TMDL in EPA regulations." Generally, pollution loads are designed to be stringent, with a focus to low flows in the streambed, because that is when vulnerability is greatest for temperature, concentration levels and other parameters.[262] When there is less total water, there is less dilution. Once the load capacity is determined, then that load of pollutants is allotted amongst the point and nonpoint sources of pollution in the basin.[263] The margin of safety is also included in this allotment and can be significant where there is little data.[264] When data is

[259] *Id.*
[260] I.C. 39-3602(10).
[261] Idaho Dept. of Envtl. Quality, *Paradise Creek TMDL: Water Body Assessment and Total Maximum Daily Load*, (December 24, 1997); And, Idaho Dept. of Envtl. Quality, *Water Quality Standards*, (April 16, 2016) http://www.deq.idaho.gov/water-quality/surface-water/standards.aspx.
[262] Guidance for Development of Total Maximum Daily Loads, at 9.
[263] Guidance for Development of Total Maximum Daily Loads, at 7.
[264] *Id.*

uncertain, the margin of safety is larger: as understanding of the watershed is improved, margin of safety can be revised.[265]

Load allocations can be further allocated by point/nonpoint, land use method, or tributary branch.[266] The measurement of the pollution is known as loading analysis, if the amount measured is over load capacity, then the needed percent reduction is given.[267] When complex biological processes allow "one listed pollutant [to] be addressed by a loading analysis of another," one TMDL is required instead of two."[268] For example, phosphorus and nitrogen are both necessary for algae growth, so limiting one can often solve the problem.[269]Surrogate measures are included. These are measures that are not quantitatively testable, but still provide a beneficial effect.[270]

Load analysis requires lots of data, and because lack of availability is not an excuse for delay, less than optimal data may be the basis of load analysis.[271] When "a more accurate load estimate" does not result in "better control actions, more equitable allocation of responsibility for load reduction and quicker improvement in water quality" gross allotments, a form of estimation are to be utilized.[272] Once further data is known, the loading analysis can and should be revised.[273] Long term projects will utilize interim goals.[274]

Idaho uses "all known potential sources of data" to create the load analysis; this includes stream gauges, stream sampling at different locations and times of the year. Some measuring

265 Guidance for Development of Total Maximum Daily Loads, at 9-13.
266 Guidance for Development of Total Maximum Daily Loads, at 7.
267 Guidance for Development of Total Maximum Daily Loads, at 9-10.
268 Guidance for Development of Total Maximum Daily Loads, at 10.
269 Paradise Creek TMDL, at 36.
270 Guidance for Development of Total Maximum Daily Loads, at10.
271 Guidance for Development of Total Maximum Daily Loads, at 11.
272 Guidance for Development of Total Maximum Daily Loads, at 11.
273 Guidance for Development of Total Maximum Daily Loads, at 11
274 Guidance for Development of Total Maximum Daily Loads, at 12.

instruments collect data constantly, but those are generally more expensive or limited to developed infrastructure sites, like a treatment plant.[275] This helps to get an understanding of the water quality, even when it is impossible to have constant testing.[276]

Improved data should lead to an increased scientific understanding of water quality, which would then allow for more exact regulation. Increased and better data should subsequently improve water quality management, dependent on any local variables not previously understood. The load assessment continues with a breakdown of potential point and nonpoint sources in the watershed.[277] This is the fundamental weakness of nonpoint load allotments, it can be very hard to measure diffuse effects in the field.

Implementation in Idaho

Implementation plans are the third step in the Idaho process.[278] While the first two steps are filed for approval with the EPA, implementation plans are state agency processes pursuant to the EPA documents, without official EPA involvement.[279] Implementation plans require specific information, such as; the time frame for goal achievement, specific schedules of actions to take place, the responsible agency, necessary documentation, required follow-up regarding data gaps, and the actual measurements of the pollutant with publication of the results.[280] Some of the information is repeated from the previous steps, the implementation plan contains all the specifics of addressing the previous two steps' determinations.[281] Once the solutions are implemented, further efforts "will be needed only where application of required and other

[275] Paradise Creek TMDL, at 36; And, Guidance for Development of Total Maximum Daily Loads.
[276] *Id.*
[277] Guidance for Development of Total Maximum Daily Loads, at 20.
[278] Guidance for Development of Total Maximum Daily Loads, at 7.
[279]Guidance for Development of Total Maximum Daily Loads, at 11.
[280] Guidance for Development of Total Maximum Daily Loads, at 12.
[281] Guidance for Development of Total Maximum Daily Loads, at 12-13.

existing pollution controls are, or are expected to be, inadequate to meet Idaho's water quality standards."[282] Idaho Code 39-3602(3) gives Idaho's definition for BMPs; BMPs are "practices, techniques or measures developed, or identified, by the designated agency and identified in the state water quality management plan which are determined to be a cost-effective and practicable means of preventing or reducing pollutants generated from nonpoint sources to a level compatible with water quality goals." [283]

Monitoring TMDLs in Idaho

Better TMDL implementation involves a cyclical loop consisting of collecting data, analyzing data, revising procedures, implementation, and then further data collection. At the outset of these processes little data were known about many water bodies. With better data, water management understanding accuracy can increase, hopefully creating a positive feedback of information and understanding. Continued monitoring is as important as WQLS listing and TMDL implementation to the long term success of the program because it allows revision of implementation to be effective. Monitoring not only helps identify problems prospectively, it helps understanding of the effectiveness of measures already in place, as well as any changes that occur. Water segments are remarkably diverse with many specific problems.

The percentage of the load allotment to acceptable margin of error can decrease with better data, when the river is actually cleaner than it was thought to be. If a river is more impaired than expected, the converse can be true. This can sometimes effectively raise the allowable discharges by sources in the community.

[282] Guidance for Development of Total Maximum Daily Loads, at 7.
[283] I.C. 39-3602(3)

Discussion

The CWA was designed to resolve the ineffectiveness of the federal water quality laws that came before, particularly in the Refuse Act and the 1948 Act. A Supreme Court decision threatened to make the Refuse Act's interpretation much broader than previously created political urgency along with notable national environmental disasters. The CWA contains both broad statements of policy goals and specific mechanisms for protecting water quality down to the level of individual watersheds and pollutants. This type of comprehensive focus is important for an interstate resource that naturally flows between states, such as water.

This water's crucial role within interstate commerce is why the commerce clause was applied to navigable waters. Due to clean waters equally significant importance to commerce, the Supreme Court later broadened federal water quality protections as problems became apparent in the 20th century. Even with an apparent need, the fight over exactly how to structure the CWA was long and involved. However, some of the more ambitious goals in the law as passed, such as the role of technology in nonpoint based standards would fall by the wayside due to the complications and costs of implementation in the decades after passage.

The broad goals include the fishable swimmable standard, the 1985 date for clean water, and the ideal that water quality standards and EPA water quality minimums would be increased over time. A broad citizen suit's provision was another method of assuring all of the nation's citizens access to the CWA's protections. The specific goals include requirements setting water quality standards, creating 303(d) lists, and implementing TMDLs, and BMPs, as well as EPA oversight of all but the BMP implementation. Cooperative federalism is essential to the Act, it allows for states, counties and municipalities to utilize their expertise, yet it also creates a shared responsibility, that can be an excuse for inaction. States take such roles because they have no choice under federal law, and they tend to find state environmental agency control preferable to EPA control. Finally, they also have significant interest in providing clean water for their citizens. Idaho and Washington both currently have implementation plans that comport with the federal framework for protecting water.

The CWA handles nonpoint source and point source pollution differently for numerous reasons, including: what was the biggest problem historically in 1972 when the law was passed, what type of pollution would be cheaper to clean up initially after passage, and what pollutant types was easier to understand at the watershed scale. While the success of the point source program is important, nonpoint pollution remains a major problem in many watersheds today, including Paradise Creek Watershed, on the Idaho Washington border.

Chapter 3: Case Study of Paradise Creek

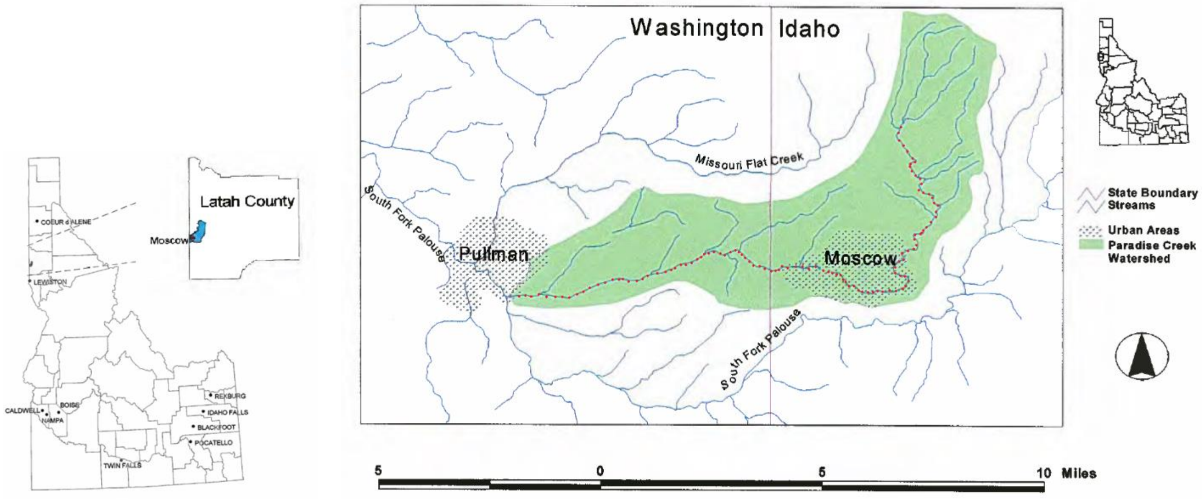

Figure 1 (Left)- Map of Idaho. Detail of Latah County, Paradise Creek watershed as the small shaded area. (Pullman not shown).[284] Paradise Creek Watershed (Right)- (Green Shaded), Waterbodies (Blue Lines), Paradise Creek (Blue Line-Dotted Red). Also shows Moscow in relation to Pullman.[285]

Description of the Watershed

Political Landscape

In Paradise Creek watershed, there are 9323 hectares (93 km^2 or 23,038 acres) in total: 5620 hectares (13,887 acres) are located within Idaho, the remaining 3703 hectares (9150 acres) are located in Washington State.[286] Figure 1 shows the location of Latah County in Idaho, the Idaho-Washington State line, and Pullman, which is in Whitman County, Washington.

Physical Landscape

From the Pacific Ocean the Columbia River leads to the inland northwest, where the Snake River flows into the Columbia. The Palouse River is a tributary of the Snake River.

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[284] Paradise Creek Watershed Advisory Group, *Paradise Creek Total Maximum Daily Load Implementation Plan*, Dec. 1999, at 10.
[285] Paradise Creek Watershed Advisory Group, at 8.
[286] Paradise Creek TMDL, at 7.

Paradise Creek is a small tributary to the South Fork of the Palouse River. The Palouse River flows over Palouse Falls which serves as a barrier to anadromous fish, or fish that migrate to and from the ocean during their lifetimes.[287]

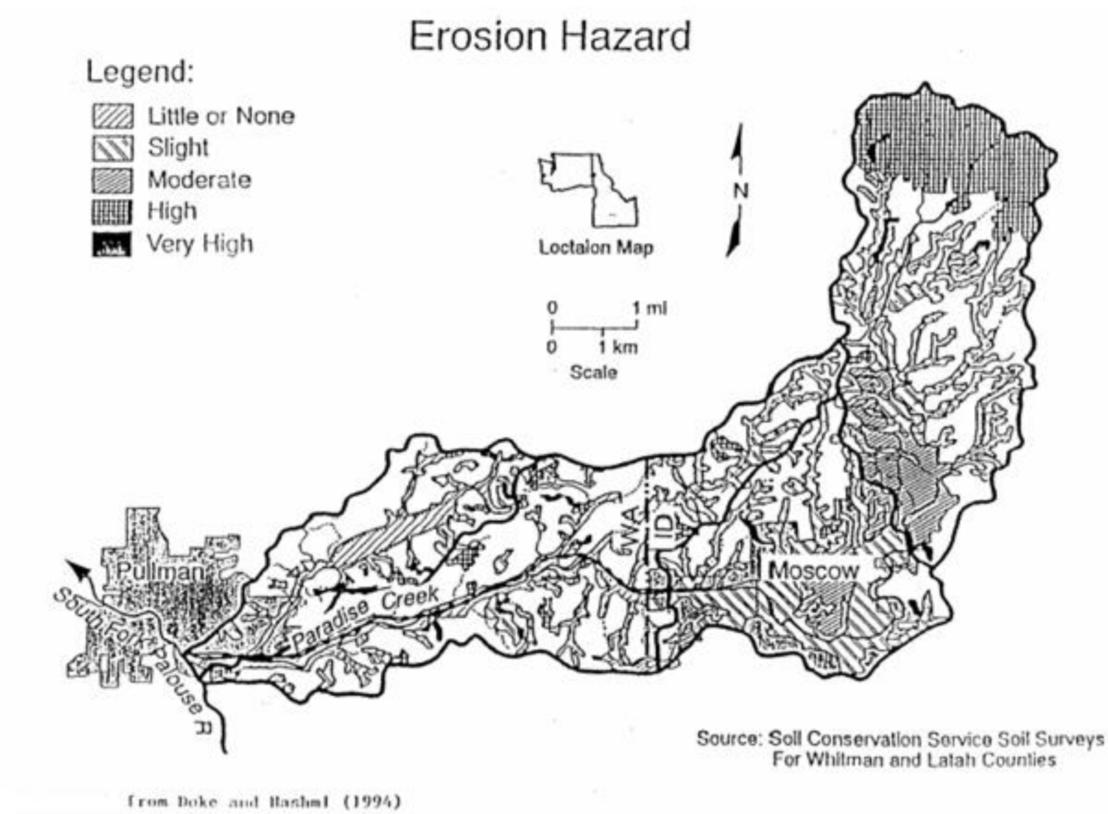

Figure 2: Erosion Hazards in Paradise Creek Watershed.[288]

Paradise Creek is included in the eastern edge of a region known as the Palouse, which is characterized by the presence of the rolling loessal hills that take up the majority of the Paradise Creek watershed.[289] The higher elevations in the Paradise Creek drainage have steeper topography, and are more likely to be forested. The majority of the drainage basin is made up of

[287] *Id.*
[288] Paradise Creek TMDL, at 16.
[289] *Id.*

"moderately steep rolling hills" which, when exposed, are naturally susceptible to erosion, see Figure 2.[290]

Paradise Creek is 30 km (19 mi.) long, with the headwaters located in the northeastern part of the watershed, known as Moscow Mountain.[291] The peak elevation in the watershed is 1,328 m (4,356 ft.) above sea level at a place in the Idaho headwaters, known as Paradise Point. The Idaho-Washington border is at 768 m above sea level.[292] Little elevation is lost between the state line and the confluence with the South Fork of the Palouse River, near Pullman, Washington.[293]

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290 *Id.*
291 *Id.*
292 *Id.*
293 *Id.*

Hydrology

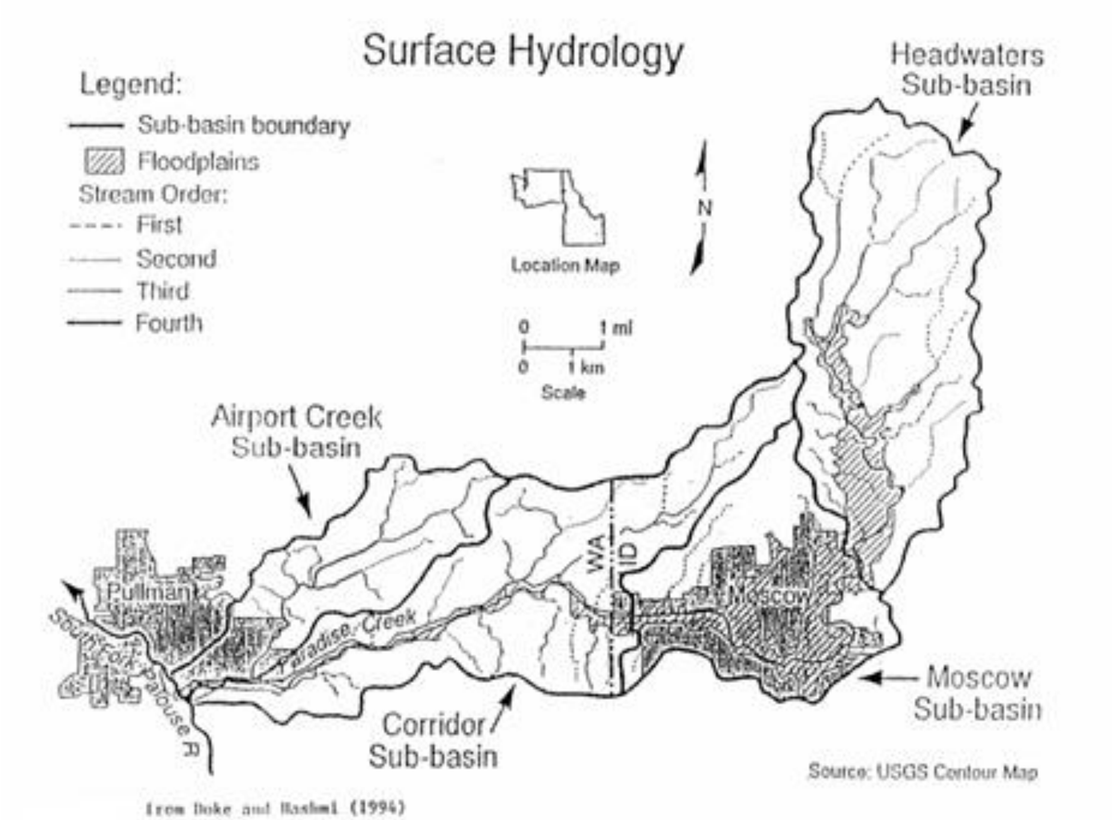

Figure 3: Map of Surface Hydrology of Paradise Creek.[294]

[294] Paradise Creek TMDL, at 10.

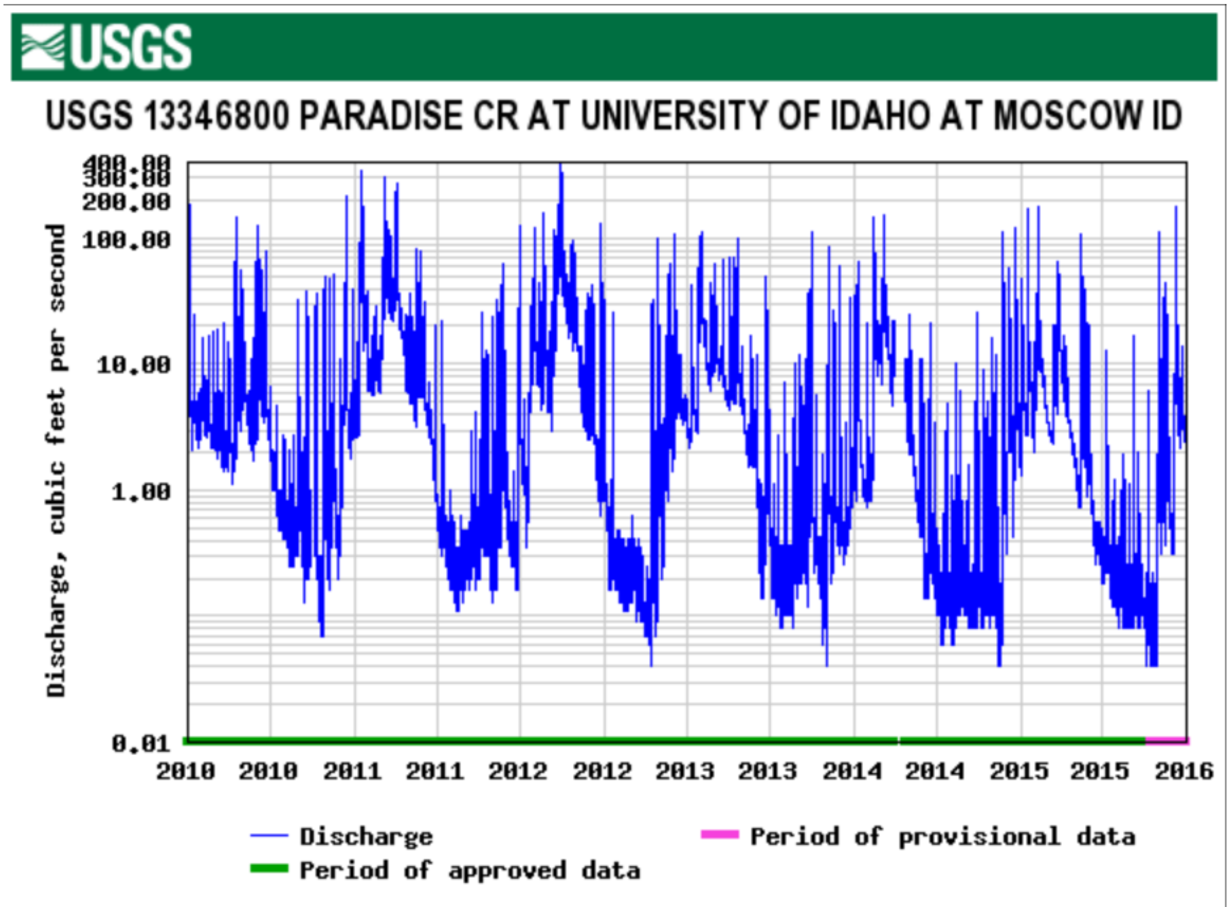

Figure 4: Paradise Creek Discharge in C.F.S., Jan. 1, 2010- Dec. 31,2015.[295]

The hydrology of Paradise Creek is highly variable, ranging from around 0.0283 m^3/s (1 ft.^{3}/s) in the dry months, to 0.5663+ m^3/s (20+ ft.^{3}/s) in the wet time of the year, as shown in Figure 4.[296]The majority of the precipitation occurs during the months of November to March, falling as snow and rain. [297] Yearly snowmelt and rains cause spring runoff events with high flows, which dwindle to a low flow during the summer and fall. Flows can range greatly from month to month and from year to year. [298] Figure 3 shows tributaries in the watershed.

[295] United States Geological Survey, *USGS Watertool Current Conditions*, (April 24, 2016), http://nwis.waterdata.usgs.gov/id/nwis/uv/?dd_cd=01_00060&format=img_default&site_no=13346800&begin_date=20100101&end_date=20151231.
[296] Paradise Creek TMDL, at 9-11.
[297] Paradise Creek TMDL, at 7.
[298] *Id.*

Land Uses

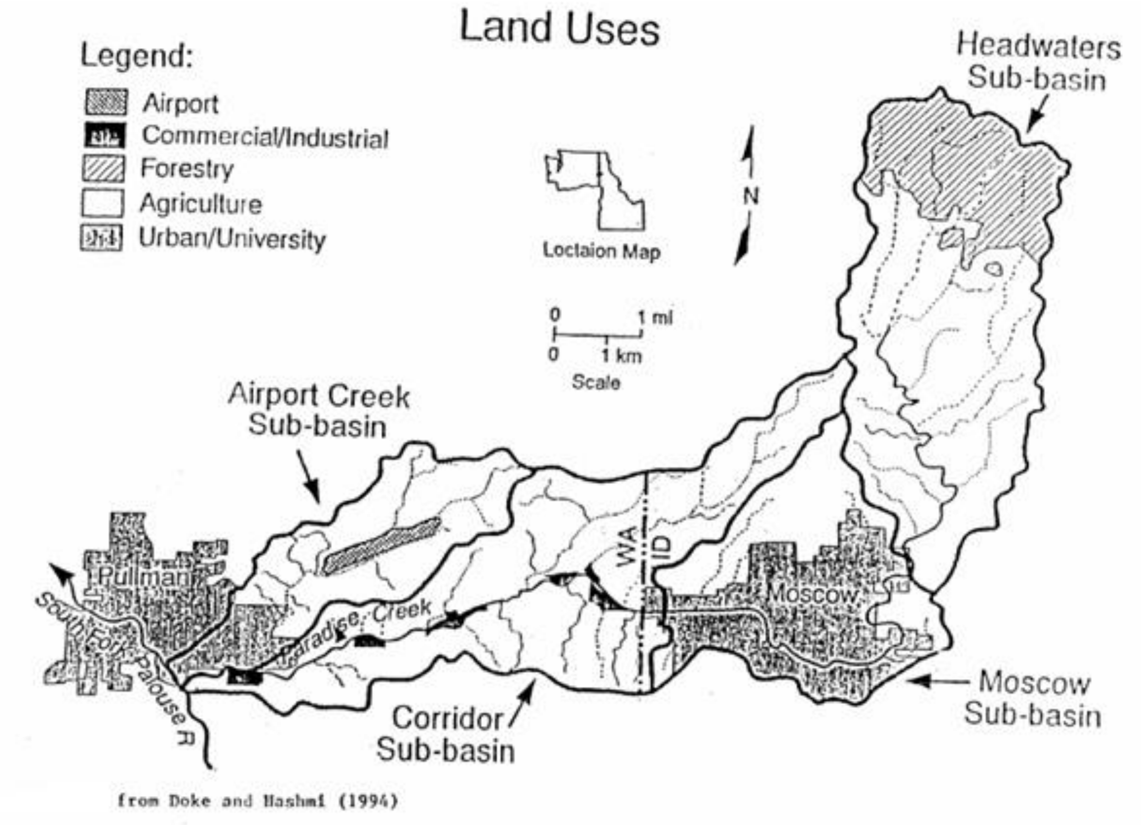

Figure 5: Paradise Creek Land Use Map.[299]

From Moscow Mountain, Paradise Creek's course runs across three major land uses, see Figure 5: forested uplands, agricultural and urban lowlands.[300] The urban area had significant channelization of the stream and other infrastructure as Moscow and Pullman grew.[301] The forested slopes of Moscow Mountain contain disbursed residential developments and some old logging roads. The forest area is used by town members for hiking, mountain biking, and other outdoor recreation. Further downstream, the topography changes to rolling hills of wheat,

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[299] Paradise Creek TMDL, at 19.
[300] Paradise Creek TMDL, at 13-14.
[301] *Id.*

barley, and lentil crops.[302] The current farming practices impact water quality because they result in erosion and sediment transport, stream temperature gain after shade loss resulting from clearing in riparian areas, riparian habitat loss, channelization, nutrients losses, and pesticide residue.[303] The Palouse is unique if compared to most other agricultural communities in the western United States because although the primary economic activity is farming with no irrigation necessary.

Historical Development in the Paradise Creek Watershed

The history of land use and water quality management in the Paradise Creek watershed provides important context to understanding the efficacy of current legal and management schemes. This section describes the historical development of: Moscow, Idaho, and to a lesser extent, Pullman, Washington, as well as, the surrounding region of the Palouse.

Early development, poor agricultural land use practices, and lack of management have had significant negative impacts on Paradise Creek's water quality. These impacts were the result of ignoring erosion, because valuable crops were being produced. The Great Depression and its low crop prices provided a momentary pause to this development, and environmental concerns were acted upon somewhat, mostly by the urging of the government. New tractors, fertilizers and pesticides were introduced quickly becoming necessary to compete as a Palouse farmer. The 1972 passage of the CWA pushed for the creation of TMDLs which was a big step in bringing a stream centered approach to planning. STEEP provided erosion control to farmers beginning at this time too. In the 1990s, when TMDLs were actually implemented after *Idaho*

[302] *Id.*
[303] Washington Department of Ecology. *Watershed Management: Palouse- WRAI 34* (2007). (April 16, 2016), http://www.ecy.wa.gov/programs/eap/wrias/Planning/34.html.

Sportsmen's Coalition v. Browner was litigated, management accelerated in Paradise Creek with new state and federal requirements.

TMDL protections were not established in Idaho by the 1979 deadline, a violation of the CWA. A legal battle in *Idaho Sportsmen's Coalition v. Browner* and other states finally prompted acceleration of CWA implementation after the delay in Idaho. Data were being compiled to set the TMDLs followed by management plans on a stream by stream basis. For Paradise Creek, the TMDL was approved in 1997 followed by a sizeable grant for implementation of best management practices in the period 2000-2002. This was based on a collaboration between state governmental agencies, non-governmental organizations and local farmers, who formed the WAG for Paradise Creek. In 2000, the University of Idaho, with a grant from the National Science Foundation, initiated a continuous monitoring program at several locations along Paradise Creek, upstream of the Moscow Waste Water Treatment Plant on the Idaho side of the state line local landowners to manage Paradise Creek watershed.

1870-1929: Settlement and Development of the Palouse

Figure 6: University of Idaho Campus Panoramic, Moscow Mountain in Distance, 1916.[304]

An early eyewitness account of the Palouse remembered the "bunchgrass rippled in the breeze like a ripe field of grain, reaching to our saddle stirrups." [305] The land in the Paradise

[304] University Of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/pg1/id/1058/rec/1323

[305] United States Department of Agriculture: Farmers' Bulletin, No. 1773., *Soil and Water Conservation in the Pacific Northwest.* Government Printing Office, Washington. (1937), at 1-3.

Creek watershed was occupied by the Palouse Indians, whose forced removal after clashes with the military and settlers prior to 1860, dispersed them between the distant Yakima reservation and other more local, larger tribes such as the Nez Perce and Coeur d'Alene.[306]

A mixed landscape of grassy pastures and forested areas dominated the Palouse region as a whole, including the Paradise Creek watershed. Riparian areas were more likely to be forested or brushy, as were land areas at higher elevations.[307] The native plant grasses held soil and protected the soil from the eroding forces of water. Along with natural soil formation processes, this landscape was able to develop a rich soil system as time went by; plant matter accumulated, died, and then re-entered the system as soil, and soil also was added by wind, thus the soil's name being loess.[308] The depths of soil present in the region are the result of thousands of years of these processes; a range for soil formation is one inch gained per 400-1000 years, depending on the type of land.[309] Below that was an even larger source of soil, five major periods of glaciation; each melt leaving major soil deposits, provided up to 50 parent layers of rich soils above a foundation of granite and basalt rock.[310] This soil was fertile, moist, and ample upon first plowing.[311]

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306 Andrew Duffin, *Remaking the Palouse: Farming, Capitalism, and Environmental Change, 1825-1914.*, (2004) The Pacific Northwest Quarterly, Vol. 95, No. 4: 194-204, At 196.
307 Paradise Creek Watershed Advisory Group, at 20.
308 *Id.*
309 *Id.*
310 Duffin, *Plowed Under: Agriculture and Environment in the Palouse*, (Univ. of Wash. Press, 2007), at 19.
311 *Id.*

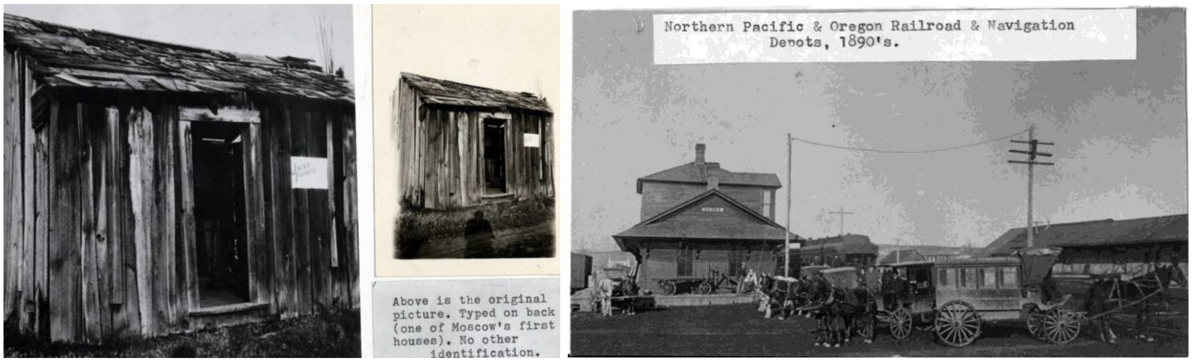


Figure 7: (Left) Early House in Moscow, 1883.[312] Northern Pacific and Oregon Railroad Navigation Depots, Moscow, Idaho, 1890s.[313]

Figure 8: (Left) Railroad Construction Crew Whitman Co., Specific location unknown, 1910.[314] (Right) Machine Shop, Moscow, 1915.[315]

In the 1870s, the first permanent American settlers came to the Palouse region, see Figure 7.[316] The first settlers subsisted primarily through grazing and agriculture, and dry land farming began in 1877.[317] In 1885, the railroad was extended to Pullman and Moscow, see

[312] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1267/rec/388
[313] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/225/rec/1037
[314] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1500/rec/1105
[315] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1496/rec/879
[316] Duffin, *Remaking the Palouse*, at 5-6.
[317] Paradise Creek TMDL, at 13.

Figures 7, and 8).[318] This new access to rail transportation allowed the farming community to sell their surplus goods at markets worldwide.[319] This resulted in farmers putting more land under till, changing grazing areas into cropland, and focusing on high dollar crops.[320] Another factor in the shift to more agriculture was that cattle hooves' deteriorated the native bunchgrass, which was not suited to heavy grazing over time.[321]

In 1892, Washington State University first opened to students in Pullman, Washington.[322] In 1889 the University of Idaho was founded; in 1892, it had its first class of students begin in Moscow.[323] With rapid growth in the region, town sanitation was a problem as early as the 1890s. Julia Bush describes in her *Early History of Pullman*; "'the town Marshall [had to] take legal measures toward the removal of a nuisance maintained by M. C. True in allowing slops and refuse of his hotel to accumulate on the ground near the hotel and the maintenance of a hog pen in his hotel yard.'"[324] The impacts of the settlement of the towns nearby to Paradise Creek were felt.

[318] Julia Bush, *Early Pullman History*, (April 16, 2016), http://www.pullman-wa.gov/about-pullman/pullman-history.
[319] *Id.*
[320] Duffin, *Remaking the Palouse,* at 196.
[321] *Id.*
[322] Duffin, *Plowed Under*, at 45.
[323] University of Idaho History, last modified (April 16, 2016), http://www.uidaho.edu/about/universityhistory
[324] Bush, n.d.

Figure 9: Elevated Sidewalk, Moscow 1902.[325]

This rise in population and land use change resulted in species loss including; black bear, cougar, lynx, coyote, grouse and birds of prey. [326] Grouse habitat "declined because they relied on bunchgrass and dense streamside vegetation" which was unavailable because in order "(t)o plant as much land as possible, farmers typically felled trees in swampy areas and along streams." [327] Figure 9 shows an elevated sidewalk in Moscow over a vegetated gulley.

[325] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/93/rec/397
[326] Duffin, *Remaking the Palouse,* at 7-8.
[327] *Id.*

Figure 10: Four Mules on a Typical Water Wagon. With a man-powered water pump on the top of water tank. Tall stick with the rope is attached to the wagon is the brake, 1900.[328]

This loss of vegetation affected cold water fish because it "removed shade from streambanks, which in turn raised water temperatures past the point that trout and other similar fish can survive. [329] Warm-water species such as chub, dace, and pikeminnow replaced the cutthroat trout."[330] Riparian vegetation, such as bunchgrass, functioned to stabilize stream channels from erosion. [331] Much of the riparian cover was trampled initially by cattle while watering, and then later to the plow. This opened the door for nonnative species to flourish.[332] Figure 10 shows a water wagon which would fill up from creeks, springs, or shallow wells; causing damage in the process.

[328] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/961/rec/2
[329] Duffin, *Remaking the Palouse,* at 7-8.
[330] *Id.*
[331] *Id.*
[332] Duffin, *Remaking the Palouse,* at 8-10.

Anecdotal evidence from early settlers depicts annual streams and springs drying up, additional evidence of a lower water table and less water stored near the surface.[333] George Northrup remembers clear small lakes and streams near the Paradise Creek watershed that were later lost to “grain farming and ditching the creeks.”[334] The Nearby North Fork of the Palouse River was used for floating logs in the earliest days of settlement on the Palouse; later flows would not support this usage of the channel.[335] Duffin attributed the deterioration to lowering water levels in addition to sedimentation of the stream beds due to high rates of erosion from plowing activity. [336]

Figure 11: (Left) Looking East across Main Street from Vacant Lot, 1889.**[337]** (Right) Livery Stable, 1901.**[338]**

[333] Duffin, *Plowed Under,* at 49.
[334] *Id.*
[335] *Id.*
[336] *Id.*
[337] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/193/rec/732
[338] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1514/rec/711

Figure 12: Agricultural Scene, 1910.[339]

Early plowing methods included use of the moldboard plow, a common tool for arid climate agriculture of the time. [340] This plow dug deep into the soil which was a benefit "because it allowed water to penetrate the ground, but it also disturbed the soil and caused erosion." [341] Early agriculture required significant livestock, see Figures 11, and 12. This resulted in erosion and sediment entering Paradise Creek, which was exacerbated because fields were plowed multiple times a year. Plowing was used for weed control in addition to planting crops.[342] In the late nineteenth century and the early twentieth century, Palouse farmers began the practice of fallowing, or planting nothing. Fallowing was done in alternating years with planting. [343] It was correctly thought to allow the land to recharge with water. Increased yields with less work resulted in widespread adoption of this practice. At this time, concern was minimal about the erosive effects of fallowing.[344] Erosion was an early problem, turn of the

[339] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/968/rec/4
[340] Duffin *Remaking the Palouse*, at 8-10.
[341] *Id.*
[342] *Id.*
[343] Duffin, *Remaking the Palouse*, at 9-10.
[344] *Id*.

century settlers remember rains known as a "gulley washer" which the storm "brought down so much soil from the hilltops that it covered fences."[345]

Figure 13: (Left) Looking Northeast at Moscow, 1885.[346] (Right) Looking Northeast at Moscow, 1887.[347]

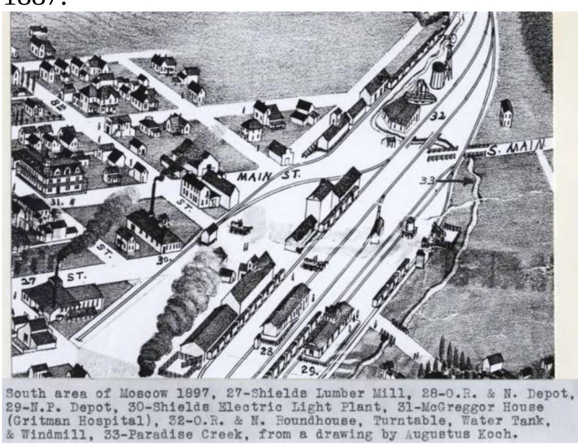
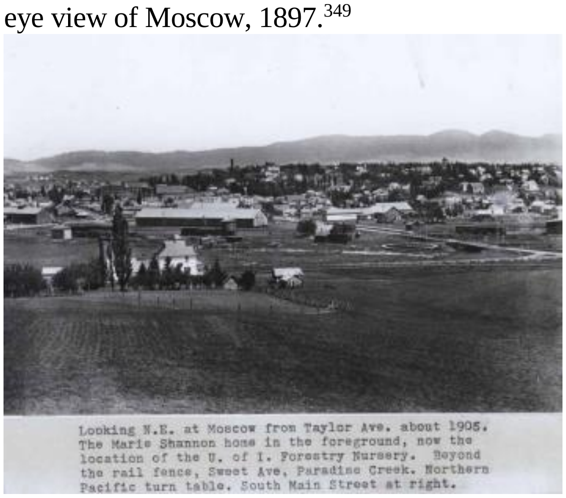


Figure 14: (Left) Birds eye view of Moscow, (Detail with Paradise Creek Labeled) 1897.[348] (Right) Birds eye view of Moscow, 1897.[349]



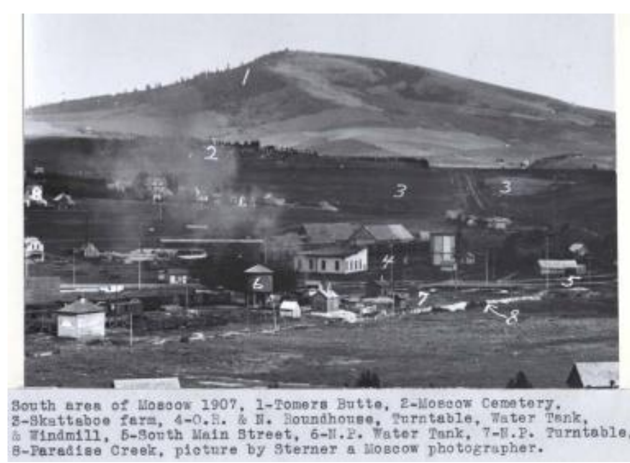


Figure 15: (Left) Looking Northeast at Moscow, from Taylor Avenue, around 1905.[350] (Right) South Area of Moscow, Paradise Creek Pictured (#8) 1907.[351]

In 1890, Pullman's Whitman County "had the most farmland, the most improved acres, and the highest value of land and buildings of any county in Washington."[352] The county generated more than $2.1 million in farm products; its nearest competitor, Walla Walla County, produced goods worth over $1.5 million."[353] Figures 13 and 14 show the development of Moscow in late 19th century and early 20th century.

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345 Duffin, *Plowed Under,* at 50.
346 University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/466/rec/309
347 University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/467/rec/310
348 University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/488/rec/312
349 University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/0/rec/240
350 University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/476/rec/311
351 University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/489/rec/313
352 Duffin, *Remaking the Palouse,* at 8-10
353 *Id.*

Figure 16: (Above Left) Farmers Union Store and Grain Office, Moscow, 1910.[354] (Above Right) First Paved Streets (in progress), Moscow, 1912.[355]

Between 1890 and 1910 the value of farm commodities increased, and this further reinforced rising farm size, technological investment, land values, and productivity. [356] In 1909, Whitman County had the highest per capita income in the U.S., due to lucrative dry land wheat farming.[357] Figure 15 shows Moscow farmers' grain office in 1910. Railroad shipping to distant markets provided swift access to buyers for the large agricultural yield. The new market economy put local farmers at the mercy of shipping rates and other factors. [358] This encouraged greater productivity, farm consolidation, and other yield based improvements. [359] Figure 16 shows the first paving of streets in Moscow.

You can see how Paradise Creek flows close to Moscow and through field in Figures 13, and 14. Figure 14 shows development on the outskirts of Moscow in 1905 and 1907.World

[354] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/404/rec/419
[355] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/382/rec/435
[356] Duffin, *Remaking the Palouse,* at 7-8.
[357] *Id.*
[358] Duffin, *Remaking the Palouse,* at 5.
[359] *Id*.

War One increased demand for food in the latter half of the decade.[360] Every year from 1915 to 1919 the price of wheat increased, as did the production of regional farms.[361] These prices encouraged every last bit of arable land to be put into wheat crops.[362] Local newspapers opposed a proposed 1920 Washington law that would have placed 10 ft (3 m) hunting corridors on either side of streams in agricultural areas for the entire state, which would remove take thousands of acres of land out of production.[363] Prices fell somewhat after the war was over, but remained steady enough for farmers to continue to prosper throughout the 1920s.[364]

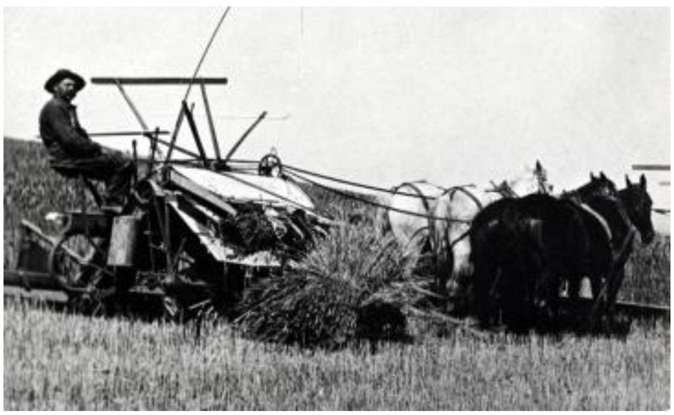

Figure 17: (Left) Joe Phillips Cutting Grain. Using a McCormick binder, on his farm, early 1900s.[365] (Right) Threshing outfit in the Blaine Valley, Latah County, 1914.[366]

[360] Duffin, *Remaking the Palouse,* at 5.
[361] Duffin, *Plowed Under,* at 56.
[362] Duffin, *Plowed Under,* at 58
[363] *Id.*
[364] Duffin, *Plowed Under*, at 58-9
[365] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1104/rec/41
[366] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/555/rec/1

1929- 1972: From the Depression to the Environmental Movement

Soil erosion concerns were growing by the early 1920s, yet little was done due to steady prices for wheat.[367] Farming was well established on the Palouse at this time, see Figure 17. In Whitman County during 1928, there were 156,940 hectares (387,806 acres) fallowed; in 1934 there were 182,801 hectares (451,712 acres).[368] A particularly harsh rainstorm in the early 1930s deposited 1 m (3 ft) of soil in farmer George Johnson's front yard. Layers of straw were spread with the intent to keep the soil in place eroded along with the soil.[369]

New Deal programs attempted to address the problem of erosion, which was a national problem, particularly in the "Dust Bowl" region of the United States.[370] The government sponsored erosion and soil research at both universities on the Palouse.[371] Local farmers frequently resisted adopting new techniques, sticking with tradition, even though evidence of massive soil loss was mounting.[372]

The USDA station also made economic arguments surrounding the switch to suggested best practices.[373] Eroded fields with deep rutting were hard on equipment and needed more energy to plow, which cost the afflicted farm approximately $250 annually, a significant sum for the time.[374] However, the USDA station failed to consider the costs of the new practices in their cost benefit analysis, resulting in little traction in the community, over the long term.[375]

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[367] Andrew Duffin. *Vanishing Earth: Soil Erosion in the Palouse, 1930-1945.* (2005) Agricultural History, Vol. 79, No. 2 173-192 (PDF), at 178.
[368] Duffin, *Plowed Under*, at 81.
[369] *Id*.
[370] Andrew Duffin. *Vanishing Earth* at 178.
[371] *Id*.
[372] *Id*.
[373] *Id*.
[374] *Id*.
[375] *Id*.

The station's workers attempted to educate local farmers about the harmfulness of the fallow, the usefulness of cover crops and other best practices on the land. [376] These included limiting summer burning, contour plowing and not farming certain areas highly susceptible to erosion.[377] A new disc plowing method was experimented with, this plow disturbed the soil less than previous methods. [378] Even physical transportation of eroded soil back to hilltops was considered, even if it would be next to impossible to implement on a grand scale, due to labor considerations. [379]

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[376] Andrew Duffin. (2005). *Vanishing Earth: Soil Erosion in the Palouse,,* at 180-82.
[377] *Id*.
[378] *Id*.
[379] *Id*.

Figure 18: University of Idaho Aerial View, Farms in distance, Paradise Creek near railroad in foreground, 1931.[380]

In 1937, the United States Department of Agriculture published Farmers' Bulletin No. 1773, titled *Soil and Water Conservation in the Pacific Northwest*.[381] This document is an excellent example of the attempt to convince locals of the importance of best management practices.[382] The report notes that native Palouse grass dominated ecosystem was no longer present in any significant acreage.[383] Within the inter-mountain zone of the Pacific Northwest

[380] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/pg1/id/1144/rec/1314
[381] United States Department of Agriculture, at 5-16.
[382] *Id*.
[383] *Id*.

region, six million acres had lost approximately half of the soil present before tilling. [384] Just fewer than two hundred thousand of the six million acres had become worthless for wheat. [385] These soil losses were significant for the region, however it promised the remaining land could "be placed on a permanent agricultural basis if erosion control measures are quickly and efficiently applied and properly planned methods of farming are followed."[386] Figures 6 and 18 provides an excellent view of the edge of Moscow in 1931, with the town in the foreground, fields in the mid ground, and forested highlands in the distance.

Figure 19: (Left) Aerial View of Moscow Civilian Conservation Corps. Camp, 1935.[387] (Right) Moscow Civilian Conservation Corps. Camp, 1938.[388]

From the 1930s through World War Two, significant federal resources were devoted to fighting erosion. [389] The Soil Erosion Service, which was later changed to the Soil Conservation Service (now Natural Resources Conservation Service), was created. [390] The Agricultural Adjustment Act contained provisions requiring good management practices in exchange for

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384 *Id*.
385 *Id*.
386 *Id*.
387 University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/cccidaho/id/450/rec/166
388 University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/cccidaho/id/444/rec/937
389 Andrew Duffin. *Vanishing Earth*, at 175.
390 *Id*.

farm aid.[391] A small and short lived Civilian Conservation Corps project was present in the region providing labor to the Soil Erosion Service, planting trees, building culverts, and repairing gullies around Moscow, see Figure 19.[392] Federal subsidies for switching to soil conserving crops, such as peas, were granted.[393]

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[391] *Id*.
[392] Andrew Duffin. *Vanishing Earth*, 180-82.
[393] *Id*.

Figure 20: (Left) Marketing Grain, 1910.[394] (Right) Agricultural Scene, Idaho National Harvester, 1911.[395]


Figure 21: (Left) Luard Gilmore's 68-horse Outfit. Plowing, harrowing, seeding, and harrowing. Also shown, team on wagon hauling seed grain for grain drills. Near Potlatch, Id. 1915.[396] (Right) Combine on the Randall farm Southeast of Moscow, near Lenville. Picture by Eggan Studio, 1917.[397]


Figure 22: (Left) Agricultural Scene. From Idaho National Harvester, 1915.[398] (Right) Agricultural Scene. Harvesting wheat with wagons. 1920.[399]

One of the strongest focal points of *Soil and Water Conservation in the Pacific Northwest* was the suggested change to the summer fallow field system, where fields were left unplanted every couple of years.[400] When the soil was first broken from the native grassland, there was significant bunchgrass plant matter still within the soil, which prevented summer erosion.[401] Figures 11, 12, 17, 20, 21, and 22 show established early farming operations of the early era. After about 12 years of farming, that plant matter from before the field was present had broken down to an extent where it changed the properties of the soil, making fields more prone to summer erosion.[402] The farming practices of the region were developed with an understanding of the soil before this plant matter was gone; by the 1930s, the most fields had been farmed longer than 12 years, even with fallow years and former pasturage.[403]

The presence of moist soil in spring and summer allows nitrate forming bacteria to flourish, a necessity in farming. In drier parts of the Northwest, water is held in the soil during fallow years, keeping the system from becoming too dry.[404] However, in the Paradise Creek area, rainfall was sufficient for annual farming in regard to soil moisture.[405] Fallowing was still beneficial in regard to nutrients; it was not beneficial due to water based soil erosion, due to the

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[394] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/979/rec/81
[395] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/986/rec/20
[396] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1017/rec/15
[397] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1088/rec/31
[398] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/987/rec/21
[399] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1382/rec/2
[400] United States Department of Agriculture, at 5-16.
[401] *Id.*
[402] *Id*.
[403] *Id*.
[404] United States Department of Agriculture, 1937, at 5-16.
[405] *Id*.

lack of protection of a cover crop throughout the rainy months when saturated soils limit water infiltration. [406]

Farmers previously fallowing in the Paradise Creek area had to weigh the benefits of additional nutrients with detriments of soil erosion. [407] Their decisions became more complicated, but also more informed.[408] The bulletin recommends crops such a legumes or sweet clover be grown in the Moscow region following fallow years; this allowed for nutrient recharge with enough ground cover to avoid erosion. [409] By mid-decade, scientists knew that "most of the soil lost each year came from the steepest hills, about ten percent of the land." [410] Even so the scientists were helpless to force change or remediation, and farmers continued to farm these high erosion areas due to the price of wheat being high.[411]

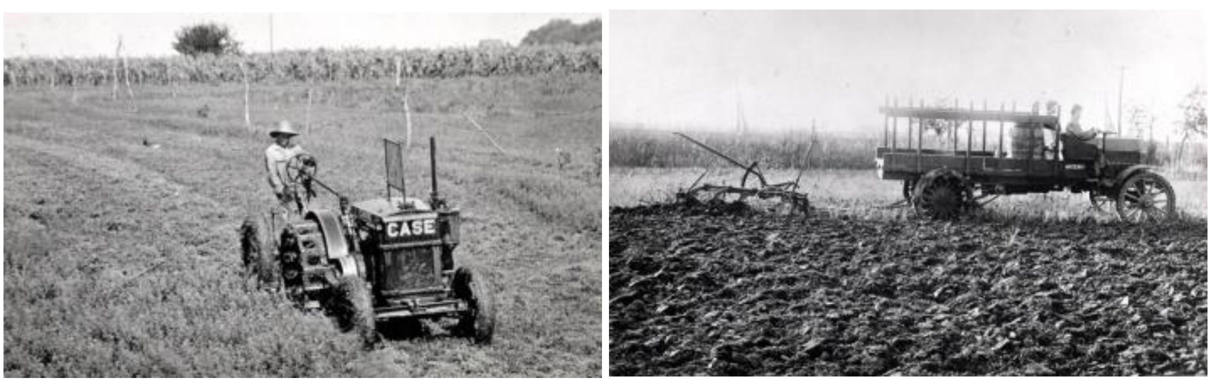

Figure 23: (Above Left) Case Tractor. Pulling a mower cutting alfalfa. Picture by T.B. Keith, around 1930.[412] (Above Right) Avery Truck Converted into a Tractor. Pulling a three bottom plow. Picture by T.B. Keith, 1930.[413]

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[406] *Id*.
[407] United States Department of Agriculture, 1937, at 5-16.
[408] *Id*.
[409] *Id*.
[410] Duffin, *Plowed Under*, at 95.
[411] *Id*.
[412] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1074/rec/26
[413] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1077/rec/27

Another shift that occurred on the Palouse was tractor use which doubled in the 1930s and the 1940s.[414] This was not promoted by the government, but by market forces.[415] The old methods of farming used massive numbers of horses, as shown Figures 11, 12, 17, 20, 21, and 22. Diesel engines and low center of gravity designs made use of the new machinery on steep hills feasible.[416] Figure 23 shows tractors, one is made from a modified truck, and this illustrates the importance of mechanized farming even for those who cannot afford the specially designed equipment. Former pastures for farming stock were no longer needed, and even more land was farmed.[417] The introduction of the one way disc plow with tractors mitigated some of the damage caused by expanded production, because it was better for erosion than the old plow type.[418] Tractors increased profits, but exacerbated an already bad erosion problem as more land was in agriculture.[419]

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[414] Duffin, *Vanishing Earth*, at 178.
[415] *Id*.
[416] *Id*.
[417] *Id*.
[418] *Id*.
[419] *Id*.

Figure 24: Floyd Trail on binder. Cutting grain on his farm northeast of Moscow. Picture from Floyd Trail. 1946.[420]

Additional technology required further investment, required even higher yields with the low prices of the 1930s to break even, which resulted in a cycle of land acquisition to pay off expensive machinery.[421] Machinery did not pay itself off if was idle, and new designs were frequent, see Figure 24. Smaller, less profitable farms went under, and were consolidated with more successful neighbors.[422]

Where government regulations during the Great Depression required a shift in practices, local farmers acquiesced.[423] However, many reforms were not systematically adopted over the long term, for various reasons, particularly, suspicion of government intrusions and the voluntary nature of most reforms, as well as local tradition.[424] Throughout the 1930s, USDA

[420] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1108/rec/44
[421] Duffin, *Plowed Under*, at 65-80.
[422] *Id.*
[423] Duffin, *Vanishing Soil*, at 178.
[424] *Id*.

and Soil Erosion Service officials attempted many different plans to get the local community to adopt these practices. [425]

Figure 25: Badly Eroded Field. On the Guy Nearing's farm north of Moscow. Severe soil loss of 200 tons per acre in the worst places. April 8, 1965.[426]

Despite the vast efforts and public investment in better farming practices in the 1930s, a 1940 study found that an average of 11.5 tons of soil were still being lost per acre, each year.[427] The advent of World War Two created high demand and urgency for food commodities, which reduced any depression era conservation concerns by both the government and individual landowners. [428] Throughout the 1950s and 1960s, wheat prices declined slightly, but remained overall profitable.[429] Significant prices for wheat, infrastructure needs, and tight margins kept

[425] *Id*.
[426] *Id*.
[427] *Id*.
[428] *Id*.
[429] Wheat Prices: 1950-2012, (April 16 2013), *www.earth-policy.org/datacenter/xls/update16_2.xls.*

erosion high, see Figure 25.[430] Figure 25 shows hillside slope that was alfalfa the last 10 years, but was plowed and reseeded as fall wheat; there is little growth, and significant ersoion.[431]

Pesticides and fertilizers were manufactured additives which helped crops resist pests and crop yields improve began to gain traction in the Palouse in the 1940s and 1950s.[432] The pesticide2,4 D was a pesticide that killed competing weeds, and it could be applied in large doses without risk to crops.[433] Less was known about other risks, such as to the environment or consumers. 2,4 D was cheap after the application equipment was purchased.[434] Another pesticide DDT was introduced to the public in 1945, and it was an anti-insect pesticide, which was helpful with the aphids that plagued wheat crops.[435]

Anhydrous ammonia was a fertilizer that provided additional nutrients for the crops, which had been degrading with the consistent erosion over time.[436] This allowed yields to remain high, but allowed for a technology to mask continued degradation within the soil.[437] When fertilizer and pesticides use accompanied by improvement in machinery increased the costs for local farming, farmers responded by consolidating farms.

1972- 1997: The Clean Water Act and Subsequent Management

In the late 1960s and early 1970s, the nation was subjected to a series of events which raised environmental awareness and created an impetus for environmental legislation at the national level (see Chapter 2). The Cuyahoga River caught fire in Ohio, a myriad of reports

[430] Duffin, *Vanishing Soil*, at 11, 15-17.
[431] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/ott/id/1098/rec/37
[432] Duffin, *Plowed Under*, at 105.
[433] *Id.*
[434] *Id.*
[435] Duffin, *Plowed Under*, at 106.
[436] Duffin, *Plowed Under*, at 105.
[437] *Id.*

came out detailing the dire state of water quality nationwide, there were record fish kills, and toxic chemical awareness came to the forefront partially as a result national awareness of DDT's harm to bird species. [438] This national groundswell of concern for water quality resulted in the CWA being passed in 1972. [439]

Inflation in the 1970s increased the price for wheat, and Palouse farmers increased production as a response to the rising prices, limiting conservation measures.[440] In the mid-1980s, however, wheat prices fell, and use of fallowing increased again.[441] Both nitrate and sediment pollution remained a serious problem in the Palouse's waterways and pesticide use greatly increased throughout the latter half of the twentieth century.[442] Water temperatures were high, with averages from 20-26 degrees Celsius, and outliers of 29 degrees Celsius. A 1974 report warned against fecal coliform levels, dissolved oxygen, sediment, and temperature.[443] The 1972-1997 time period had two important events for water quality in the Paradise Creek Watershed, Solutions to Environmental and Economic Problems (STEEP) and the implementation of the CWA. These important events will be discussed in this order.

In 1975, STEEP was founded; STEEP was "an innovative interdisciplinary research/education program focusing on developing profitable cropping systems technologies for controlling cropland soil erosion and protecting environmental quality."[444] Washington State University, University of Idaho, and Oregon State University collaborated with the USDA Agricultural Research Service, growers, other government agencies, and industry.[445]

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[438] Robert Adler, et al., *The Clean Water Act; 20 Years Later*, (Washington D.C., Island Press, 1993) at 5.
[439] Andreen, at 255.
[440] Duffin, *Plowed Under*, at 143.
[441] *Id.*
[442] Duffin, *Plowed Under*, at 131.
[443] Duffin, *Plowed Under*, at 139.
[444] STEEP, *Conservation Tillage Systems Information Resource*, (May 2016), http://pnwsteep.wsu.edu/.
[445] *Id.*

In a 1982 paper by Dennis L. Oldenstadt, he explains the STEEP's concept was to create programs accessible to farmers and that, "erosion control requires major modifications in tillage practices, the development of new crop varieties, and different methods of weed, insect, disease, and rodent control."[446] UDSA funding for this program began in 1976.[447] The 1982 paper describes 55 scientist having worked on the program within the first 6 years, and says the program should be judged on whether erosion is curtailed within the next decade.[448]

STEEP's efforts were known as conservation farming. Conservation farming had a gradual increase in implementation over the 1970s and 1980s, partially due to further decreases in soil viability making it increasingly hard to ignore the losses of erosion via bolster yields with fertilizers and other technical improvements.[449] No-till farming was developed, which resulted in significantly less soil erosion, often with greater pesticide use. Pesticides could cause their own water quality problems, but it was a seen as a welcome addition to a system under siege of sedimentation.[450]

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[446] Dennis L. Oldenstadt, et al., *Solutions to Environmental and Economic Problems (STEEP),* 1982.
[447] *Id.*
[448] *Id.*
[449] Duffin, *Plowed Under*, at 144.
[450] Duffin, *Plowed Under*, at 146-7.

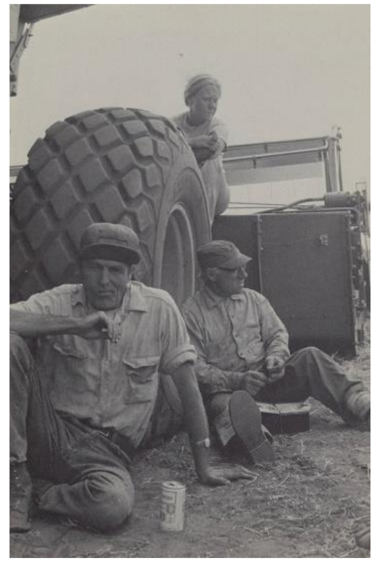

Figure 26: (Left) Grain truck in Wheat Field, 1982.[451] (Right) Lunch in the Shade of a Combine. During pea harvest, 1982.[452]

By the mid-1980s no-till had somewhat fallen out of vogue, despite the positive elements of reduced erosion, because yields were limited under this method. The Farm Security Act of 1985 instituted the Conservation Reserve Program, which required implementation of these conservation farming methods on farms in exchange for subsidies farms were already dependent on. [453]From 1974 to 1994 conservation farming methods such as: "stubble mulching, strip cropping and tree planting- showed massive acreage gains."[454] Stubble mulching prevented sedimentation by leaving large material in the at the soil surface. Strip cropping and tree planting removed highly erodible areas either partially or wholly from cultivation.[455]

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[451] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/nwpostcards/id/739/rec/548
[452] University of Idaho Special Collections, (March 1, 2016), http://digital.lib.uidaho.edu/cdm/singleitem/collection/nwpostcards/id/740/rec/876
[453] Duffin, *Plowed Under*, at 155.
[454] Duffin, *Plowed Under*, at 155.
[455] *Id.*

The STEEP program was behind much progress against soil erosion of the 1970s, 1980s, 1990, 2000s.[456] The 1975 erosion rate for the Pacific Northwest region was 20tons/acre/year.[457] The 1990 rate was a little over 10 ton/acre/year, and the 2005 rate was 5tons/acre/per year.[458] This shows a massive improvement over time. STEEP accomplished better ways of no-till farming, with improved equipment, seeding systems, pest management, weed management, moldboard plow use has declined, no till has increased, crop rotations are improved and yield-risk management.[459] Tractor horsepower has increased.[460] There are 50% fewer farm operators today than there were in 1970, and farm size has increased.[461] Soil erosion decreased for most of the time STEEP has been active and is expected to continue.[462] STEEP has educated the community and growers are more receptive to conservation farming.[463] The STEEP Impact Assessment feels more farmers would adopt conservation practices, if there was more funding.

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[456] STEEP, *Impact Summary 2007,* (May 4, 2016), http://pnwsteep.wsu.edu/STEEP_impact_summary_2007.pdf.
[457] *Id.*
[458] *Id.*
[459] STEEP, *Impact Assessment 2007,* (May, 7 2016), http://pnwsteep.wsu.edu/STEEP_impact_report_2007.pdf.
[460] *Id.*
[461] *Id.*
[462] *Id.*
[463] *Id.*

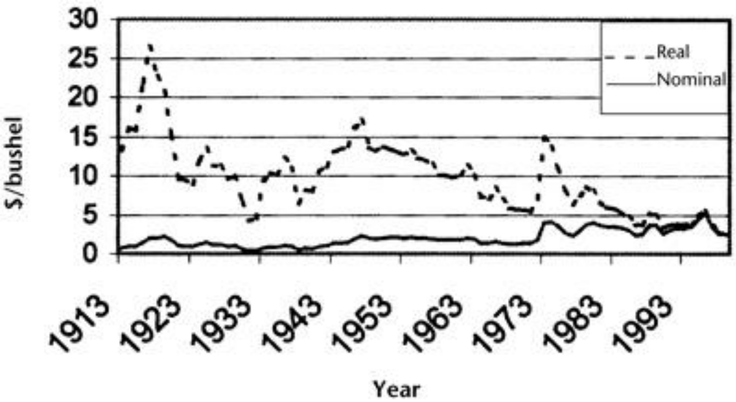

Figure 27: Real and Nominal Wheat Prices, 1913-1993.[464]

Throughout the twentieth century, the market price of wheat, also known as the nominal price, had generally trended upward, but the real price, adjusted for inflation and other factors, had steadily been decreasing, see Figure 27.[465] Farm consolidation, tractor usage, pesticide use and other efficiency improvements have allowed farms to produce more and remain competitive with lower crop purchasing power per bushel grown.

Besides anti-erosive measures designed to stop individual landowners from losing valuable soil, 1972-1997 was when the CWA was implemented, causing a separate source of efforts to improve water quality for different reasons. When the CWA was passed in the early seventies, the first TMDLs were due on June 26, 1979. Idaho did not submit a WQLS list until 1989, which is ten years after the due date and 17 years after the law was passed. Subsequently, the EPA failed to act until 1992, when a new list was submitted by Idaho, including only 36 rivers. The second list was challenged and ruled to be under inclusive.[466] In October of 1994,

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[464] Rhonda Skaggs, *New Mexico State University, Agricultural Experiment Station, College of Agriculture and Home Economics Technical Report 37- The Future of Agriculture: Frequently Asked Questions*, (April 16 2016), http://aces.nmsu.edu/pubs/research/economics/TR37/welcome.html.pdf.
[465] *Id.*
[466] *Idaho Sportsman's Coalition v. Browner*, 951 F.Supp. 962, 964-65 (W.D. Wash. 1995).

the EPA made a list with 962 WQLSs. EPA's schedule runs for 25 years, until 2021. Idaho and EPA argued any faster progress would be premature due to the lack of good data.[467]

Environmental groups were frustrated with the disregard for deadlines and the lack of progress with TMDLs. They sued the federal EPA and the State in a case that became known as *Idaho Sportsmen's Coalition v. Browner*. [468] Carol Browner was the head of the EPA at the time. Idaho Sportsmen's Coalition objected to the EPA and the State of Idaho's plan because implementation was too slow and thus an abuse of discretion. [469] The EPA claimed they had fully complied with the previous Court order to make a plan and they had little data to act on immediately.[470]

The United States Code sets out the principles for courts' review of an agency's action or inaction, 5 U.S.C. § 706(2)(A) states:

> To the extent necessary to decision and when presented, the reviewing court shall decide all relevant questions of law, interpret constitutional and statutory provisions, and determine the meaning or applicability of the terms of an agency action. The reviewing court shall (2) hold unlawful and set aside agency action, findings, and conclusions found to be (A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.[471]

Courts in the 9th Circuit have interpreted this to mean that there must be a rational connection from the facts to the decision of the agency.[472] It is the duty of the court to "decide whether the agency considered the relevant factors and whether there has been a clear error of judgment."[473] Furthermore, "On questions of statutory construction, courts must carry out the unambiguously

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[467] *Id.*
[468] *Idaho Sportsman's Coalition v. Browner,* at 966.
[469] *Id.*
[470] *Id.*
[471] 5 U.S.C. § 706(2)(A).
[472] *Natural Resources Defense Council, Inc. v. U.S. E.P.A.,* 966 F.2d 1292, 1297 (9th. Cir. 1992).
[473] *Id.*

expressed intent of Congress."[474] Congress is allowed to leave gaps in legislation where decisions are delegated to agency, due to agency expertise and agency ability to reconcile conflicting policies.[475]

Idaho Sportsmen's Coalition prevailed, when the Court held that the EPA plan for Idaho was an abuse of discretion because it was overly slow.[476] The Court acknowledged the implementation of the CWA was under a tight schedule and with limited data. However, this is moot due to presence of clear deadlines. According to the Court; "lack of precise information must not be a pretext for delay(.)"[477]

The EPA's role is to implement the CWA and other federal environmental laws. [478] The EPA allows delegation of CWA compliance and monitoring to state agencies; which is what is currently happening in most states, including the State of Washington.[479] In six states (including Idaho), the EPA directly oversees NPDES compliance and monitoring by the state.[480] Idaho does the nonpoint source management by setting water quality standards and TMDLs[481]. The State agencies are active in compliance monitoring of watersheds under either system.[482]

Where data were insufficient, administrators were supposed to account for the "margin of safety" and still take action. [483] The Court noted that in 17 years, Idaho had only finished

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[474] *Id.*
[475] *Id.*
[476] *Idaho Sportsman's Coalition v. Browner,* at 966-67.
[477] *Id.*
[478] EPA, *Watershed Academy Web, Introduction to the Clean Water Act,* (April 16 2016), https://cfpub.epa.gov/watertrain/moduleFrame.cfm?parent_object_id=2788.
[479] *Id.*
[480] *Id.*
[481] *Id.*
[482] *Id.*
[483] *Idaho Sportsman's Coalition v. Browner,* at 967-69.

three TMDLs, which did not include Paradise Creek. The Court ordered the EPA to resubmit a new plan in six months. [484]

After the case was decided, Idaho Sportsmen's Coalition and EPA reached a settlement where all Idaho TMDLs would be established by 2005, an eight year period.[485] Idaho was one of a few states targeted by environmental groups concerned with the widespread lack of TMDLs, across the nation.[486] Both the State of Idaho and the State of Washington have numerous state level laws protecting their watersheds in addition to CWA/EPA delegated duties. State environmental agencies produce numerous reports and management plans which help protect water quality, in addition to TMDLs.[487]

Discussion

Sediments have been a problem since the native grassland was removed, along with native wildlife, people and the ecosystem. Hooved animals trammeled the riparian areas caused the first gulley washes of the newly plowed and unprotected steep slopes. Other development further destabilized land, and as mechanization increased less land was used as pasture. Destructive plowing traditions, such as the moldboard plow, fallowing, and plowing as a method of removing weeds held equal weight for some farmers as did new less destructive methods. Even where new science prevailed it was often slow, incompletely implemented, and restricted by market conditions that encourage yield maximizing over other considerations. Despite these continuing economic incentives significant progress has been made towards conservation farming with STEEP.

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[484] *Id.*
[485] *Settlement Agreement*, at 1-2.
[486] *Idaho Sportsman's Coalition; Friends of the Wild Swan, Inc. v. U.S. E.P.A.*; And, *Sierra Club v. Hankinson*.
[487] EPA, *Watershed Academy Web, Introduction to the Clean Water Act.*

The history of Paradise Creek is one of development and technology. Economic priorities trumped other considerations for most of the history, particularly so the early history when the soil was considerably deeper, and environmental priorities less prominent in society. Technology improvements, production increases and larger farms were constants even as the economy fluctuated some over the first hundred and twenty years of development. Traction was gained on erosion control through farmer based program such as STEEP. The watershed management scheme for Paradise Creek since 1997 is discussed in the next chapter.

Chapter 4: CWA Water Quality Management, 1997-2016

Understanding the management of Paradise Creek is complicated: numerous management plans overlap, with varying degrees of implementation. Both Idaho and Washington have separate plans for managing for water quality, although some management plans span both sides of the border through cooperation of governments and other parties. First, the Idaho TMDL for Paradise Creek is discussed in depth, and briefly compared to Washington's process.

Besides understanding the many management plans, it is important to understand the participants who are active in managing water quality. These range from government agencies to non-governmental organizations. Government agencies also have a wide range of involvement with different roles, at multiple levels: from the Federal EPA, to state agencies, county governments and the municipalities. Finally, recent scientific studies of the Paradise Creek watershed show the strengths and weaknesses of the management programs.

1997 Paradise Creek Idaho TMDL

As a part of the settlement of *Idaho Sportsmen v. Browner*, the 1997 Paradise Creek TMDL was created to control nonpoint source water quality problems in the watershed, with Paradise Creek getting early priority for TMDL implementation.[488] The first two steps of Idaho's TMDL implementation process, sub-basin assessment and loading analysis, were combined into a single document, as allowed under the regulations.[489]

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[488] Guidance for Development of Total Maximum Daily Loads, at 27.
[489] *Id.*

To create this TMDL, data were derived from a United States Geological Survey monitoring station approximately 800 m upstream from the Washington State border.[490] When one state of an interstate waterway has a stricter standard, both states follow the more strict limitation.[491] Records from Moscow's wastewater treatment facilities were used along with previous water quality studies of the area.[492] Data gaps were acknowledged in Idaho's TMDL guidance document; future monitoring and testing would fill in lacking data going forward.[493] Nutrient testing and temperature testing in particular needed better data in this watershed.[494]

The loading assessment continues with a breakdown of potential point and nonpoint sources in the watershed.[495] Point sources included the Moscow wastewater treatment plant, and UI aquaculture facilities.[496] Nonpoint sources included agriculture, livestock, forestry, urban areas, household waste, construction, septic system failure, gravel mining, gravel roads, recreation and wildlife.[497] Agriculture and urban runoff are the primary nonpoint pollutant sources in Paradise Creek watershed.[498]

The load assessment for Paradise Creek concluded with a breakdown of the seven pollutant types included in the 1997 TMDL, their concentrations, and target goals, "based on numeric water quality standards where they exist, or interpretation of narrative water quality standards in the case of sediment and nutrients."[499] Paradise Creek is listed for seven pollutants

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[490] Paradise Creek TMDL, at 22-23
[491] *Id.*
[492] Guidance for Development of Total Maximum Daily Loads, at 23.
[493] Guidance for Development of Total Maximum Daily Loads, at pg. 10-27.
[494] *Id.*
[495] Guidance for Development of Total Maximum Daily Loads, at 20.
[496] Guidance for Development of Total Maximum Daily Loads, at 20-21.
[497] Guidance for Development of Total Maximum Daily Loads, at 25.
[498] *Id.*
[499] Guidance for Development of Total Maximum Daily Loads, at 30.

on Idaho's 1996 CWA 303(d) list: nutrients, sediment, temperature, flow alteration, habitat modification, pathogens, and ammonia. Cold water biota, secondary contact recreation, and agricultural water supply are the designated beneficial uses that require support."[500]

Pollutant goals, total loads, respective allocations and water body capacity were individually established for sediment, phosphorus, temperature, bacteria and ammonia levels.[501] Each of these will be individually discussed in the following sections. Flow alteration and habitat modification were implemented by narrative standards and the others by load analyses.[502] Narrative standards were not assigned load allocation because "they do not lend themselves to meeting the minimum requirements of a pollutant load (mass/time) as defined by EPA guidance on TMDL development." Flow modifications and habitat modifications will be ameliorated through actions used to limit other pollutants and other surrogate measures as they are not easily measured numerically.[503]

The load analysis of Paradise Creek identified the pollutants as two general types; four pollutants that cause eutrophic conditions (rapid growth of algae) and three total pollutants that affect recreation and cold water biota.[504] The pollutants that cause eutrophic conditions were nutrients, ammonia, temperature, and flow alteration.[505] Sediment, pathogens, and habitat modification affected secondary recreation and cold water biota.[506] Paradise Creek is a small watershed that clearly exhibits the multitude of considerations just a few pollutants can cause.

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500 Guidance for Development of Total Maximum Daily Loads, at 30.
501 *Id.*
502 *Id.*
503 *Id.*
504 Paradise Creek TMDL, 21.
505 *Id.*
506 *Id.*

Even in a short distance, sourcing pollution is difficult, as is the decision on what is reasonable as load allocation, for many pollutants.

Sediment Loading

According to the Paradise Creek TMDL, the water contains sediments, which may be damaging to fish and other aquatic life when present in high concentrations.[507] Only 356 tons per year of sediments were allowed in Paradise Creek annually. According to the TMDL report, this "was derived by applying the TSS [total suspended solids] target as a floating increment above estimated background concentrations."[508] Cold water biota are impaired when more than 15 mg/L of TSS are present. Paradise Creek exceeded this amount in 1997.[509]

Table 1: Sources of Sediment Loads, 1997 TMDL.[510]

Source of Load	Amount (Tons/yr)
MWWTP Wasteload Allocation[1]	91
SITE Wasteload Allocation[2]	5
Nonpoint Load Allocation (LA)[3]	156
Margin of Safety (MOS)[4]	104
TSS Load Capacity	356

[1] Based on maximum concentration of 15 mg/l for the permitted 4.0 MGD.
[2] Based on maximum concentration of 15 mg/l for an estimated 140 gpm.
[3] Based on background levels and allowed concentrations above background.
[4] Reflects 10 percent of current nonpoint load.

The Moscow Wastewater Treatment Plant (MWWTP) was the only point source in violation of sediment loads.[511] Per their own measurements, the plant was producing about 91 tons of sediment per year and they were allowed 44 tons annually, per NPDES permit.[512] Another point source, the University of Idaho's Aquaculture facilities (SITE) was allowed 5 tons annually, but was within that limit.[513]

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[507] Paradise Creek TMDL, at 30-33.
[508] *Id.*
[509] *Id.*
[510] Paradise Creek TMDL, at 37.
[511] Paradise Creek TMDL, at 30-33.
[512] *Id.*
[513] *Id.*

A total of 156 tons of nonpoint source sediments are allowed annually.[514] Nonpoint sediment sources include agriculture, livestock, forestry, urban runoff, household hazardous waste, construction, septic system failure, gravel mining, recreation and wildlife.[515] To meet that goal, a 75% percent reduction of nonpoint source sediments would be required. Estimates of TSS are based on land use. The origin of nonpoint TSS pollution was allocated as followed: 80% from agricultural areas, 7% from forested areas, 5% from urban areas, and 8% from county roads.[516]

Margin of safety was 10% of the current load, or 29% of the load capacity which was based on concentrations of 15 mg/L of TSS (104 tons per year for margin of safety).[517] Data used were USGS flow data and three times per week measurements of TSS concentrations by the Moscow Wastewater Treatment Plant.[518] Due to limitations in the data "[t]he margin of safety was based on current load to compensate for uncertainties inherent in the background sediment calculations."[519] Ultimately, "(t)he Palouse hills are very susceptible to erosion due to their topography, soil texture, and land use practices which result in a lack of vegetative cover during the period of maximum precipitation(.)"[520]

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514 Id.
515 Paradise Creek TMDL, at 30.
516 *Id.*
517 *Id.*
518 *Id.*
519 Paradise Creek TMDL, at 37.
520 *Id.*, at 3.

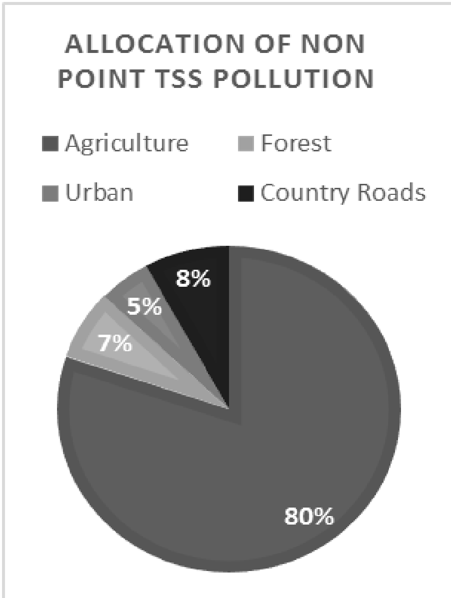

Figure 28: TSS Pollution Allocation.[521]

Temperature

The target temperature of the 1997 Paradise Creek TMDL is 18 °C, per Washington's standard and Paradise Creek's status as an interstate waterway.[522] This is in order "to support aquatic biota and to limit algae growth."[523] Temperature data sets needed improvement; they were only collected three times per week, year round, at 8am.[524]. Since data were lacking, estimates were used to determine the nonpoint sources within Paradise Creek watershed, and the water was probably in excess of 18 °C in the summertime.[525] Moscow's wastewater treatment plant was one degree in excess of the 18 °C TMDL, at 19 °C, during the summer.[526]

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[521] *Id.*
[522] Paradise Creek TMDL, at 34.
[523] *Id.*
[524] Paradise Creek TMDL, at 23.
[525] Paradise Creek TMDL, at 34.
[526] *Id.*

A 42% reduction in nonpoint heat loads is needed to achieve the temperature goal.[527] Table 3 shows target stream temperature exceedances from 1988-1992.

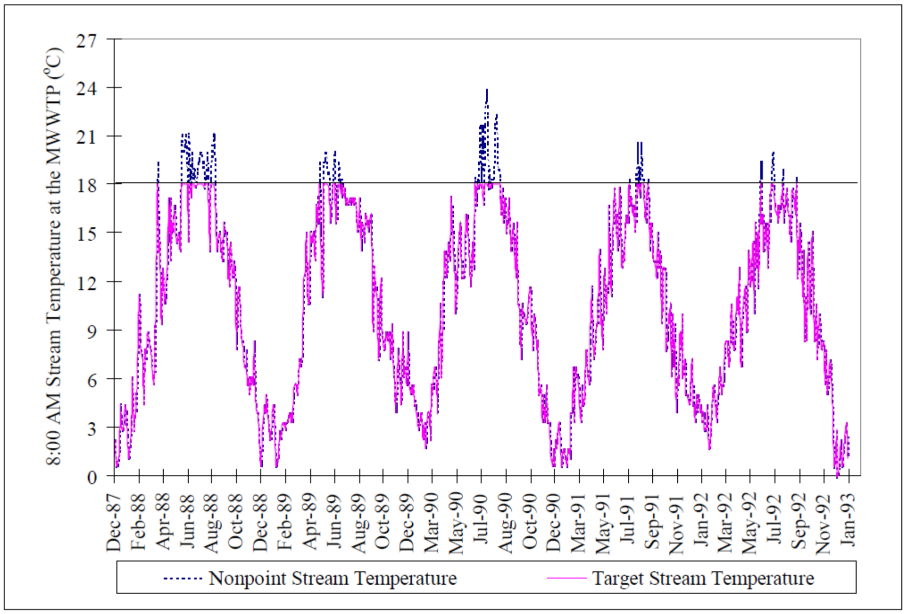

Figure : Target Stream Temperature Exceedences, 1988 - 1992

Figure 29: Target Stream Temperature Exceedances, 1988-92.[528]

Measurements were adjusted as "current temperature condition upward greater reductions in thermal input are called for, providing assurance the target will be met even if the difference between morning and maximum temperature is an underestimate."[529] Additionally, a 10% margin of safety "was also applied to the [water treatment plant] effluent temperature for the current loading assessment." [530] Figure 29 shows the target stream temperature exceedances for a period prior to the TMDL, which was utilized in forming the TMDL.

[527] Paradise Creek TMDL, at 35-36.
[528] Paradise Creek TMDL, at 90.
[529] Paradise Creek TMDL, at 39-40.
[530] Paradise Creek TMDL, at 39-40.

Nutrients

Nutrients in Paradise Creek pose a dual problem; both phosphorus and nitrogen are considered nutrients.[531] Both were present and above the allowed amount. [532] Phosphorus is easier to remove, it is the focus of the load allocation.[533] By choosing to limit phosphorus and not nitrogen potentially money is saved. If phosphorus is reduced properly, even if there is excess nitrogen remaining, algae growth should is limited.[534] If phosphorus reduction methods are unproductive, "nitrogen species… may need to be examined in a future phase of the TMDL."[535] Phosphorus was considered a summer problem, when flows were low. [536]

Table 2: Total Phosphorus Allocation.

Source of Load	Amount (lbs/day)
MWWTP Wasteload Allocation[1]	4.5
SITE Wasteload Allocation[2]	0.2
Nonpoint Load Allocation (LA)[3]	0.9
Margin of Safety (MOS)[4]	15%
Total P Load Capacity[5]	5.6

[1] Based on concentration of 0.136 mg/l for the permitted 4.0 MGD.
[2] Based on maximum concentration of 0.136 mg/l for an estimated 140 gpm.
[3] Based on concentration of 0.136 mg/l and mean growing season streamflow of 0.8 MGD (1.2 cfs).
[4] Margin of safety is implicit in the load capacity of 5.6 rather than 6.6.
[5] This is an average growing season load capacity, load capacity on any given day will vary with flow.

The phosphorus target was the natural background or approximately 0.136 mg/l.[537] In 1997, according to the TMDL, MWWTP contributed "approximately 85% of the [Total

531 Paradise Creek TMDL, at 36.
532 *Id.*
533 *Id.*
534 *Id.*
535 *Id.*
536 *Id.*
537 Paradise Creek TMDL, at 42.

Phosphorus] load above background to Paradise Creek annually and 98% of the [Total Phosphorus] load during the growing season."[538]

For nonpoint sources of phosphorus, Idaho urban nonpoint sources were estimated at 797 kg [1,758 lbs] per year, or about 24% of the nonpoint load for Idaho. The remainder of the phosphorus load was assumed to be from agricultural and forest activities linked to sedimentation.[539] There are multiple types of phosphorus, particularly concerning are orthophosphates.[540] In a healthy system, orthophosphates make up a small percentage of the total phosphorus.[541] Orthophosphates cause plant growth and eutrophication, because they are quickly taken up by plant matter.[542] A 12% to 92% orthophosphate range was given for Paradise Creek, it was basically unknown with that wide of a range.[543]

Orthophosphates often attach to sediment in the water.[544] The nutrients analysis stated that "at present, there is no data to prove it, a logical assumption" was made regarding the nutrient problem. [545] That assumption was "nutrients are not a year round problem in Paradise Creek" due to the fine sediments and the flashy hydrology "it is reasonable to assume that most of bottom sediments are flushed during winter/spring high flows prior to the subsequent growing season and renewed accumulation of sediment with nutrients.[546] Therefore, it is assumed that there is an annual exchange of sediment and associated phosphorus; but no long

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538 *Id.*
539 Paradise Creek TMDL, at 44.
540 Paradise Creek TMDL, at 37.
541 *Id.*
542 *Id.*
543 *Id.*
544 *Id.*
545 Paradise Creek TMDL, at 38-39
546 *Id.*

term storage occurs."[547] Better data was needed as well as a more complete understanding of phosphorus in Paradise Creek.

Pathogens

Pathogens were tested for using fecal coliform as a surrogate; these indicate presence of bacteria that can be harmful to human health.[548] The Washington standard is 100 colony forming units per milliliter (cfu/ml) standard, the Idaho standard is 200 cfu/ml; Washington's stricter standard will apply to both states since Paradise Creek is an interstate stream.[549] MWWTP was a source, because when data were collected from the water on either side of the MWWTP, the upstream level was higher.[550] Based on these data, an 18% reduction was needed by MWWTP from their average of 4.19×10^9 cfu per day. SITE was in compliance with its TMDL for pathogens. Non-point source reductions were estimated to need approximately a 75% percent reduction, due to the high concentrations upstream.[551]

Ammonia

Ammonia can be taken up by organisms which contribute to eutrophication. A more stringent standard for ammonia was applied in Washington than in Idaho. [552] A standard of 13.0 mg/l from November to March and 9.4 mg/L are from April to October, this converted to "targets [of] 1.9 mg/L maximum daily and 0.9 mg/L average monthly limits for April through

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547 *Id.*
548 Paradise Creek TMDL, at 41.
549 *Id.*
550 *Id.*
551 *Id.*
552 Paradise Creek TMDL, at 47.

October; the targets are 2.9 mg/L daily and 1.5 mg/L monthly for November through March."[553] The total allocations are "29.9 lbs/day (April-Oct) and 49.9 lbs/day (Nov-March)."[554]

MWWTP is the most significant source of ammonia on Paradise Creek, as a point source, they are being ordered to comply.[555] "The MWWTP allocations are 28.5 lbs/day (April-Oct) and 47.5 lbs/day (Nov-March). [SITES] allocations are 1.4 lbs/day (April-Oct) and 2.4lbs/day (Nov-March). The ammonia nonpoint source load allocation is variable depending on flow, but averages 9.3 lbs/day (April-Oct) and 32.8 lbs/day (Nov-March) based on the data sets"[556] As explained in Table 5, the MWWTP's allocations were based on the proposed NPDES permit amounts.

Table 3: Ammonia Loading.[557]

Summary ammonia loading information:

Pollutant	Targets	Daily Average Concentration	Daily Average Load	Daily Average Load Capacity	Daily Allocation
Ammonia*					
NPS					
Apr-Oct.	0.9 mg/l	0.08 mg/l	0.6 lbs	9.8 lbs	9.3 lbs
Nov.-March	1.5 mg/l	0.15 mg/l	1.8 lbs	34.5 lbs	32.8 lbs
MWWTP					
Apr-Oct.	0.9 mg/l	4.24 mg/l	141.5 lbs	30 lbs	28.5 lbs
Nov.-March	1.5 mg/l	6.13 mg/l	205 lbs	50 lbs	47.5 lbs
Aquaculture					
Apr-Oct.	0.9 mg/l	<0.1 mg/l	<1.8 lbs	1.5 lbs	1.4 lbs
Nov.-March	1.5 mg/l	<0.1 mg/l	<1.8 lbs	2.5 lbs	2.4 lbs

For ammonia load calculations, disregarded sample results for 5/4/93. Extremely high flow values (5 times next highest values) significantly skewed loading upward. There is high variability for all loading data presented above due to day to day variabilities in flow. MWWTP load calculations are based on a 4.0 MGD proposed permit discharge limit.

553 *Id.*
554 *Id.* 29.9 lbs. =13.6 kg. 49.9lbs. =22.6 kg.
555 Paradise Creek TMDL, at 44.
556 Paradise Creek TMDL, at 49. 28.5 lbs. =12.9 kg. 47.5lbs. =21.5kg. 1.4lbs. =.63kg. 2.4lbs. =1.1kg. 9.3 lbs. = 4.2 kg. 32.8lbs. =14.9 kg.
557 *Id.*

Implementation in Idaho

Implementation plans are the third step in the Idaho process which was described earlier. Specific implementation plans for Paradise Creek are discussed here.

Table 4: TMDL Significant Implementation Agencies for 1997 TMDL.[558]

Implementing Agency	**Subject Matter**
Department of Lands	Timber harvest, oil, gas, and mining issues
Soil and Water Conservation Commission	Grazing and agriculture issues
Department of Transportation	Public road issues
Department of Agriculture	Aquaculture issues
Department of Environmental Quality	Environmental issues
U.S Forest Service	Federal Forest Service land in Idaho
U.S. Bureau of Land Management	Federal Bureau of Land Management territory in Idaho

Yearly progress reports from the State of Idaho to the EPA were initially required by the settlement. Currently, reports are required every two years.[559] Paradise Creek's implementation plan is many faceted. Many restoration efforts, such planting trees and buffer zone efforts, had already begun before the TMDL process required action, by groups such as the Palouse Clearwater Environmental Institute (PCEI).[560] PCEI is discussed below, in the section on non-governmental organizations. These restoration efforts are long term efforts against nonpoint sources, because they reduce erosion, provide vegetation and eventually shade for temperature

[558] *Id.*
[559] Settlement Agreement.
[560] Paradise Creek Watershed Advisory Group, 7.

relief.[561] The rest of the implementation plan focused on nonpoint source mitigation and monitoring, since point sources are limited by appropriate NPDES permitting.[562] Community outreach also has occurred throughout these processes.[563]

Table 5: 1997 TMDL Implementation Measures.

Item	Location	Water Quality/Flow Improvement Project	Responsible Parties	Status	Targeted Parameters				
					Flood/Flow	Sediment	Phosphorous	Temperature	Bacteria
21	D' St. to Bridge St.	Potential revegetation project	PCEI	Summer '99/ Spring '00		X	X	X	
22	Latah County Fairgrounds	Potential revegetation project	PCEI	Summer '99/ Spring '00		X	X	X	
23	Troy Hwy. to Hwy. 95	Potential revegetation project	PCEI	Summer '99/ Spring '00		X	X	X	
24	Ghormley Park	Potential revegetation project	PCEI	Summer '99/ Spring '00		X	X	X	
25		Sedimentation/Erosion control ordinance	City of Moscow	Completed		X	X		
26		Storm water management ordinance	City of Moscow	Completed	X				
27		Budgeted (FY00) $10,000 for a consultant to assess the Paradise Cr. drainage	City of Moscow	Pending	X				
28		TMDL/Discharge permit	City of Moscow	Pending/EPA		X	X	X	X
29		TMDL - Sediment/Erosion control above city limits	City of Moscow	Pending	X	X	X		
30		TMDL - City storm water	City of Moscow	Pending/DEQ		X	X		
31		Contacted Fish and Game; beaver dams and beaver trapping; no beavers found	City of Moscow	Completed	X				
32		Sandbagging plan	City of Moscow	Completed	X				
33		EPA Grant; Latah Water/Soil Conservation Dist.			X	X	X		

[561] *Id.*
[562] *Id.*
[563] Paradise Creek Watershed Advisory Group, at 11.

The specific requirements for sediments, temperature, nutrients, pathogens and ammonia were laid out in the load discussion, the implementation plan then describes mitigation plans that will address these levels by land use type.[564]

Agricultural and non-forest lands are addressed with riparian strips, grass erosion control, and channel realignment.[565] Efforts were to be phased in with priority given to efforts that can have the quickest or largest impacts.[566] Three types of practices in this program are agronomic, structural, and riparian. These all address erosion.[567] Agronomic efforts are those which strive to keep soil covered. Structural efforts strive to address fast flowing water, which causes erosion.[568] Riparian efforts are the installation of buffer strips and grass strips along water bodies.[569] BMPs for avoiding erosion via tillage practices are also described. [570] Bi-weekly monitoring occurs where Paradise Creek enters the city limits.[571]

Another management plan includes Latah County Highway District's agreement to a rural road plan, which will limit nonpoint source pollution from rural roads into Paradise Creek.[572] Culverts were to be installed and efforts would be taken to stabilize road cuts, which limit sedimentation and subsequent nutrients from polluting water ways.[573] Fifteen to 25 percent of county roads were to be addressed for the cost of approximately $100,000.[574]

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564 Paradise Creek Watershed Advisory Group, at 2, 6-7.
565 Paradise Creek Watershed Advisory Group, at 10-11.
566 Paradise Creek Watershed Advisory Group, at 13.
567 *Id.*
568 Paradise Creek Watershed Advisory Group, at 15.
569 Paradise Creek Watershed Advisory Group, at 14.
570 Paradise Creek Watershed Advisory Group, at 17-18
571 Paradise Creek Watershed Advisory Group, at 21.
572 Paradise Creek Watershed Advisory Group, at 10.
573 Paradise Creek Watershed Advisory Group, at 27.
574 Paradise Creek Watershed Advisory Group, at 29-30.

The forested lands plan requires the Idaho Department of Land (IDL) and NRCS to implement compliance with the Idaho Forest Practices Act, particularly anti-sedimentation measures: BMPs in risky areas, better ditching, and improved seeding methods.[575] Monitoring was to done be via public-private partnership, with IDL having yearly inspection authority.[576] Funding for forestry plans gained via a 0.05 cent charge per acre and a 0.08 cent charge per thousand board feet with deficit to be a made up from other government sources.[577]

The urban lands plan included surveys of point sources, channel reconstruction, re-vegetation, stabilization and wetland restoration.[578] This plan addressed the stream within city limits, via a multiple part plan of education and management practices within the city.[579] Monitoring was to occur at MWWTP and other point sources, with enforcement within the urban land plan is via City statute.[580]

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575 Paradise Creek Watershed Advisory Group, at 10.
576 Paradise Creek Watershed Advisory Group, at 34.
577 Paradise Creek Watershed Advisory Group, at 35.
578 Paradise Creek Watershed Advisory Group, at 10.
579 Paradise Creek Watershed Advisory Group, at 41-42.
580 Paradise Creek Watershed Advisory Group, at 45.

Monitoring Provisions in the 1997 TMDL

Table 6: Table of Initial TMDL monitoring Schedules and Agencies.[581]

Monitoring Summary for the Paradise Creek Watershed

Parameter	Monitoring Objective	Responsibility	Reporting Sequence
Sediment	BMP Effectiveness	**IASCD/IDA/IDL**	**3-5 years**
	Source & Transport	**IASCD/IDA/IDL**	**3-5 years**
	Trend Analysis	**MWWTP/IDEQ/IDA**	**3-5 years**
Temperature	Trend Analysis	**MWWTP/IDEQ/IDA**	**annual**
Phosphorus	BMP Effectiveness	**IASCD/IDA/IDL**	**3-5 years**
	Source & Transport	**IASCD/IDA/IDL**	**3-5 years**
	Trend Analysis	**IDEQ**	**3-5 years**
Pathogens	NPDES Compliance	**MWWTP**	**per NPDES permit**
Ammonia	NPDES Compliance	**MWWTP**	**per NPDES permit**
Beneficial Use Support Status	BURP	**IDEQ**	**3-5 years**

Monitoring in Idaho after 1997

An essential aspect of a TMDL functioning is effective watershed monitoring, it allows evaluation of whether the plan is effective. In 2002, a Paradise Creek monitoring report was released, prepared for Idaho by Cary Myler, a water quality analyst at the Idaho Association of Soil Conservation Districts (IASCDs). This report utilized nine monitoring locations along Paradise Creek. [582] Twenty-four stream improvements were installed in late 2001 and early 2002 to target sediment.[583] The goal was to remove 334 tons a year of sediment per year from

[581] Paradise Creek Watershed Advisory Group, at 28.
[582] Cary Myler. *Paradise Creek: Monitoring Report 2002*, (2002) at 8-12.
[583] Myler, at 4.

Paradise Creek, the "control structures" built actually removed 1002 tons of sediment by trapping it in these structures for later removal.[584]

Temperature was under the limit for all nine monitoring locations for the two years of data present. Two of nine monitoring locations were in violation of the dissolved oxygen parameter relating to cold water biota. [585] Sediment loading from all Paradise Creek monitoring sites combined, exceeded the TMDL seven times in 2001 and twice in 2002. [586] Phosphorus was in exceedance of the TMDL for all of 2001 but only for the spring runoff in 2002, which did not violate the TMDL.[587] Additionally, in the second year, there was upstream disturbance from constructed meanders to restore the stream, which would have resulted in a temporary increase in phosphorus and sediment readings. [588] This monitoring report had positive overall indications for the watershed and its new management plans, even if data were only collected for two years. Data monitoring responsibilities were handed off to the University of Idaho at this point.[589] The data by the University of Idaho would inform the latest management science and policy, as discussed below.

Today the 1997 TMDL remains in effect, however one aspect may be changed in the near future. The Idaho DEQ prepared an addendum for E Coli bacteria in Paradise Creek for 2015.[590] IDEQ released the completed document in October 2015, this document only addressed ecoli.[591] This is one example of how state agency obligations toward TMDLs are

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[584] *Id.*
[585] *Id.*
[586] *Id.*
[587] *Id.*
[588] Myler, at 8-12.
[589] *Id.*
[590] Idaho Department of Environmental Quality, *DEQ seeks comment on water quality improvement plan for Paradise Creek, 2015*, (April 16, 2016), https://www.deq.idaho.gov/news-archives/2015/january/water-paradise-creek-ecoli-bacteria-tmdl-addendum-comment-011615/.
[591] Idaho Department of Environmental Quality, *Paradise Creek TMDL 2015 Bacteria Addendum*, (April 23, 2016), https://www.deq.idaho.gov/media/60177629/paradise-creek-tmdl-2015-bacteria-addendum.pdf.

continual even after implementation, yet review has not occurred as comprehensively or as frequently as described in Table 9 above. Better TMDL implementation involves a cyclical loop consisting of collecting data, analyzing data, revising procedures, implementation, and then further data collection.

1997 Paradise Creek Watershed Plan

The Paradise Creek Management Plan is the most comprehensive attempt to manage the watershed so far- as it incorporated parties from both sides of the state line. It was led by Paradise Creek Management Committee; which consisted of many organizations: Palouse Conservation district, Latah Soil and Water Conservation District, both county governments, both city governments, both cities business districts' organizations, both cities' public works departments, agricultural groups from both states, PCEI and Pullman city -trust. [592] State agencies included: IDEQ, Washington's Department of Ecology, both state universities, and water research centers for each state.[593] EPA and U.S. fish and wildlife contributed from the federal level.[594]

Created by the Paradise Creek Management Committee, a group comprised all willing stakeholders with the goal "to characterize the watershed, to identify water quality problems and their sources, and to identify and prioritize activities."[595] Due to the wide range of parties involved the recommendations have a strong basis in the community.[596] The committee recommended that "Washington's Department of Ecology conduct a Use Attainability Study to

[592] Washington Department of Ecology, Palouse Watershed Plan, 2007 at 25
[593] Washington Department of Ecology, Palouse Watershed Plan, 2007 at 25
[594] Washington Department of Ecology, Palouse Watershed Plan, 2007 at 25
[595] Palouse Conservation District and the Paradise Creek Management Committee, at 34.
[596] Palouse Conservation District and the Paradise Creek Management Committee, at 30.

re-evaluate the Class-A stream designation in Washington for Paradise Creek to develop a classification consistent with Idaho DEQ's classification."[597]

The Plan determined "nonpoint source pollution is extremely difficult to quantify because it originates from large undefined areas such as a clear-cut forests, city streets, and agricultural fields."[598] Source identified included: "agriculture, livestock, forestry, urban runoff, household hazardous waste, construction, septic system failure, mining, recreation, and chemically contaminated sites."[599] While the exact contribution of nonpoint pollution in Paradise Creek was "unknown," agriculture was "the major nonpoint source of pollution to Paradise Creek" with 83% of the land usage.[600] Additionally, higher nutrient levels resulted from the movement of "soluble nitrates and from phosphorus attached to sediments."[601]

Within the watershed, urban land use is small in acreage, but "Moscow sub-basin contributed a higher level on a per acre basis of sediments than did the upstream agriculture and forestry lands." Another significant impact identified was the MWWTP effluent, it constitutes 90% of the flow during the low natural flows.[602]

The following BMPs were recommended by the committee: improved plowing practices, shank and seed practices to minimize the effects of tillage, installing sediment retention structures, managing grazing practices along riparian areas and buffer areas along stream banks with diverse vegetation for channel stabilization, wildlife habitat, and shading to lower stream temperatures.[603] The Plan also contained a list of past and future activities planned

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[597] *Id.*
[598] *Id.*
[599] *Id.*
[600] *Id.*
[601] Palouse Conservation District and the Paradise Creek Management Committee, at 44.
[602] Palouse Conservation District and the Paradise Creek Management Committee, at 48.
[603] Palouse Conservation District and the Paradise Creek Management Committee, at 51.

with these goals in mind, participants include local non-governmental organizations along with government partners. [604]

Washington State Management

The State of Washington divides its watersheds into Water Resource Inventory Areas (WRIAs), Paradise Creek's Washington acreage is within WRAI 34, which contains the entire Palouse River watershed.[605] The WRAIs are in many ways comparable to Idaho's BAGs. In 1997, the Washington legislature passed the Watershed Planning Act, which provided state funding to an integrated approach to manage water resources.[606] This provided sources of funding for Paradise Creek management from the State of Washington.[607] The integration was between the public agencies and local non-governmental organizations. This type of integration is a common way for TMDLs and BMPs to be implemented. The Watershed Planning Act was followed a year later with more legislation designed to set a framework for developing local solutions to watershed issues on a watershed basis" according to the Washington Department of Ecology's website, Watershed Management.[608] This program awards grants on a two year funding cycle. Prioritization is merit based.[609]

Washington State's management functions in many similar ways to Idaho's. A 2004 document, titled Phase Two- Level One Technical Assessment: for the Palouse Basin: WRAI 34 was prepared, for Washington State, by a consulting firm, Golder Associates. [610] It contains a

[604] Palouse Conservation District and the Paradise Creek Management Committee, at 50-57.
[605] Golder Associates, *Phase Two- Level One Technical Assessment: for the Palouse Basin: WRAI 34.*, (2004).
[606] Washington Department of Ecology, *Watershed Management*, (April 16, 2016), http://www.ecy.wa.gov/watershed/.
[607] Palouse Conservation District, and the Paradise Creek Management Committee. (1997). *Paradise Creek Watershed Water Quality Management Plan,* at 50-57.
[608] Washington Department of Ecology, *Watershed Management.*
[609] *Id.*
[610] *Id.*

larger data set than the 2002 monitoring report prepared for Idaho, mentioned above, and less positive results.[611] Under this data set, Paradise Creek was found to exceed standards every summer for temperature, bacteria, nitrogen, and phosphorus.[612]

WRAI 34 received a grant from the state which created the "Palouse Watershed Planning Group," who created an implementation plan, the "Palouse Watershed Plan" (2007).[613] This plan sets forth ideas for the watershed such as major projects for the watershed. Additionally, the Palouse Watershed Planning Group made instream flow recommendations after gathering flow and habitat data in cooperation with Washington State University. [614] The watershed planning group is in many ways comparable to Idaho's WAGs. The Palouse Watershed Plan (2007) is very similar to the Paradise Creek Management Plan (1997). Many of the 2007 Watershed Plan recommendations mirror the 1997 Paradise Creek Management Plan, although the overall geographic scope is larger. This document is just for Washington and not for the watershed like the 1997 Paradise Creek Management Plan.[615]

Non-Governmental Organizations

In addition to the governmental agencies that created the TMDLs and watershed plans for the Paradise Creek watershed, there are numerous non-governmental agencies which work towards improving water quality in the watershed. PCEI is primarily an environmental educational group, which organizes the community for various events, including annual

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[611] Golder Associates, *Phase Two- Level One Technical Assessment: for the Palouse Basin: WRAI 34.,* (2004); And, Myler at 1-27.
[612] Golder Associates.
[613] HDR/EES, *Palouse Watershed Plan, 2007*. Notes. Prepared for Washington Department of Ecology, HDR EES is consulting firm that worked in association with Golder Associates.
[614] *Id.*
[615] *Id.*

cleanups of Paradise Creek.[616] PCEI has been involved in numerous larger projects (see Table 7) in the watershed in including; planting trees in riparian zones, installing erosion control fabrics, re-opening the flood plain, restoring the creek to its natural meanders, installing wetland cells to handle wastewater from a treatment plant, and planning to treat storm water from parking lots, roads, and houses.[617] Non-governmental organizations are particularly capable due to their ability to get funding from different sources, grants, states, and federal. PCEI has taken tangible community support to "leverage outside funding from state and federal pollution prevention contracts."[618]

PCEI is an example of how governmental management can collaborate with non-governmental organizations and community members to provide for BMP implementation and other educational opportunities for citizens. These citizens groups allow for citizens to speak together for a louder voice. They have also provided other means which to promote the issues these citizens are concerned about. These groups, whether governmental or private, all work together as part of the management quilt for the Paradise Creek watershed; many management roles overlap, while others do not. Overall, what recent success there has been in the Paradise Creek watershed is a result of strong nongovernmental organizations working with other actors in government and private business.

Recent Studies of Paradise Creek

One of the benefits of the local universities is that local scientists have been investigating Paradise Creek and the pros and cons of the current management schemes as it develops. In 2006, Amber Rand produced a document titled: *A Summary of Nutrient*

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[616] Palouse Clearwater Environmental Institute. (n.d.). *Our History*. (April 17, 2016), http://www.pcei.org/history/.
[617] *Id.*
[618] PCEI, *Our History*.

Concentrations in the Paradise Creek Watershed, as part of the environmental sciences program.[619] Rand described the recent land management efforts of IASCD, the Idaho Soil and Water Commission and the Latah County Soil and Water Commissions' as nutrient concentrations were problematic enough that the EPA was threatening Moscow with new wastewater infrastructure.[620] Twenty-four structural and other physical stream improvements from the Paradise Creek Implementation Plan that were installed in 2001 and 2002 were credited for significantly improving the situation. [621] In the 2005 and 2006 water years nitrates were within the TMDL limit for load allocations. [622] The highest concentrations were when flows were lowest, close to the limit, but usually below the standards. [623]

Rand also discussed phosphorus in her report, where MWWTP shows a load 86.6% in excess of the TMDL.[624] The timing of these high concentrations indicate these high levels were associated with sediment transport, and high flows. This was the opposite of the nitrates.[625] Phosphorus levels were trending up from the numbers in the 2002 monitoring report, discussed above, as well as the 2005 numbers when compared to the 2006.[626] Additionally, this report recommends further research regarding the summer months' concentration level, as the TMDL is applicable for the summer months. [627]

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[619] Amber Rand, *A Summary of Nutrient Concentrations in the Paradise Creek Watershed*, 4/26/2006, (Unpublished) submitted to Jan Boll/Tom Scallhorn at Moscow water dept., at 4-9.
[620] *Id.*
[621] *Id.*
[622] *Id.*
[623] Rand, at 4-9, 20.
[624] Rand, at 13.
[625] *Id.*
[626] Rand, at 20.
[627] Rand, at 20-21.

Rand also discussed orthophosphate, a type of phosphate, which is known to cause eutrophication.[628] The levels of orthophosphate found were above levels known to cause this problem for the entire 2006 water year.[629] Particularly troubling was orthophosphate's ability to have high concentrations in similar flow patterns to nitrates (low flow) as well as phosphorus (high flows). She recommends more research on orthophosphate and more work is needed summarizing data for all nutrient pollutants into reports.[630]

A 2006 study of tillage methods on the Palouse states "more than 40% of Palouse cropland is under conservation tillage and water erosion rates are reduced from previous levels, but still exceed the tolerable rate."[631] Water erosion was caused by plowing in the fall before high precipitation, or freshly planted winter wheat fields without significant surface residue.[632] Loss of surface residue can be from excess tillage or from previous crops, such as peas or lentil, which have less residue.[633] No-till methods "will provide year-long and season-to-season protection against water erosion where-as tillage-based systems, especially those involving moldboard plowing, are vulnerable to erosion at several stages."[634] While many of the no-till conservation methods Kennedy and Shillinger have been discussing in the region for decades, these methods are still slow to gain complete implementation.

A study titled *Long-term Sediment Loading Trends in the Paradise Creek Watershed* was published in 2010. This study's findings help understanding of Paradise Creek's current

[628] Rand, at 17.
[629] *Id.*
[630] Rand, at 20-21.
[631] Ann C. Kennedy and William F. Schillinger, *Soil Quality and Water Intake in Traditional-Till vs. No-Till Paired Farms in Washington's Palouse Region* (2006).
[632] *Id.*
[633] *Id.*
[634] *Id.*

state of sediments and land management.[635] The current yields with heavily fertilized systems are on par with early yields due to the natural richness of Palouse soil.[636] The last 100 years have taken a toll: "all the original topsoil had been lost from 10% of the cropland, and one-fourth to three-fourths of the original topsoil had been lost from 60% of the cultivated area."[637]

Table 7: Description of Management Practices Installed, 2000-2003.[638]

Description of management practices installed between 2000 to 2003 in the Paradise Creek watershed.

Description	Amount	Cost
Rural region		
Riparian buffer	8.5 ha	
Gully plugs	19	
Structural improvements (e.g., rock chutes)	11	
Conversion to direct seed/high residue management	552 ha	$900,000
Stream bank stabilization	7.4 km	
Riparian restoration (i.e. brush/tree seedings)	14.1 ha	
Wetland restoration	1.4 ha	
Forested region		
Installation of cross drains	2.4 km*	$36,000
Rock road surface	2.4 km	
County roads		
Stabilize eroding cut banks	670 m	$77,000
Stabilize eroding bridge crossings	2	
Urban region		
Stream bank stabilization	7.1 km	$770,000
Riparian restoration	6.5 ha	
Wetland restoration	655 m^2	

* The number of cross drains depended on local slope and road surface conditions.

The study found that even with "improved soil conservation practices over the last 80 years [that] have significantly reduced soil erosion rates" sediment loading in the stream has not shown sufficient reductions to meet the TMDL.[639] The study found a "statistically significant decreasing trend in overall sediment load" based on switches in tillage and "management practices have targeted gully erosion and stream bank failures."[640]

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635 E.S. Brooks, et al., *Long-term Sediment Loading trends in the Paradise Creek Watershed. Soil and Water Conservation Society*. (2010).
636. *Id.*
637. *Id.*
638 *Id.*
639 *Id.*
640 *Id.*

It was found that urban sources actually could account for an average of 43% of annual sediment loads.[641] The TMDL estimated that urban sources only accounted for 5% of the total load. There could easily be a direct relationship between a management plan that underestimates urban nonpoint sources and continued high sediment loss from Moscow's urban area. The overall load of sediments in the stream remains high and researchers have postulated that large stocks of sediment already in the stream may be to blame.[642] Improvements in water quality were "attributed to improvements made in the rural region of the watershed." Mr. Brooks notes, the progress that was made was thought to be due to term adoption of conservation practices, specifically the exclusion of burning of wheat stubble, avoidance of summer fallow, and minimized tillage erosion.[643]

In the 2012 report, *How to Build Better Agricultural Conservation Programs to Protect Water Quality: The National Institute of Food and Agriculture–Conservation Effects Assessment Project Experience,* chapter 12 is titled: *Paradise Creek Watershed, Idaho* (NFA report).[644] This report contains both interesting social and scientific information regarding the watershed.[645] The NFA report did a social survey of regional farmers.[646] While results are not exclusive to the watershed, the report filtered regional growers. They were highly educated, with 80% having at least an undergraduate degree.[647] Growers believed that: "erosion has been

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641 *Id.*
642 *Id.*
643 *Id.*
644 D.L. Osmond, et al., *How to Build Better Agricultural Conservation Programs to Protect Water Quality: The National Institute of Food and Agriculture–Conservation Effects Assessment Project Experience; Chapter 12: Paradise Creek Watershed, Idaho. (2012)*, "NFA report,"http://www.swcs.org/documents/filelibrary/conservation_programs_to_protect_water_quality/Front_matter_2D401E5A8DA15.pdf.
645 *Id.*
646 *Id.*
647 *Id.*

reduced," and "[w]ater quality stewardship was high."[648] Profit was a primary concern for 63% of respondents and decisions were influenced most by growers.[649] Targeting of conservation measures to problematic areas was sometimes accepted, it varied on the wording of the survey questions.[650] Conservation incentives and other voluntary measures were popular.[651] Buffers strips were used 50% of the time, no tillage was used 60% of the time, conservation tillage 85% of the time.[652] Many conservation practices were seen as an economic cost and inconvenient.[653] The economics "of implementing and maintaining conservation practices remained important in on-farm decision making."[654] 96% of survey respondents thought "reducing soil loss is important for conservation."

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648 *Id.*
649 *Id.*
650 *Id.*
651 *Id.*
652 *Id.*
653 *Id.*
654 *Id.*

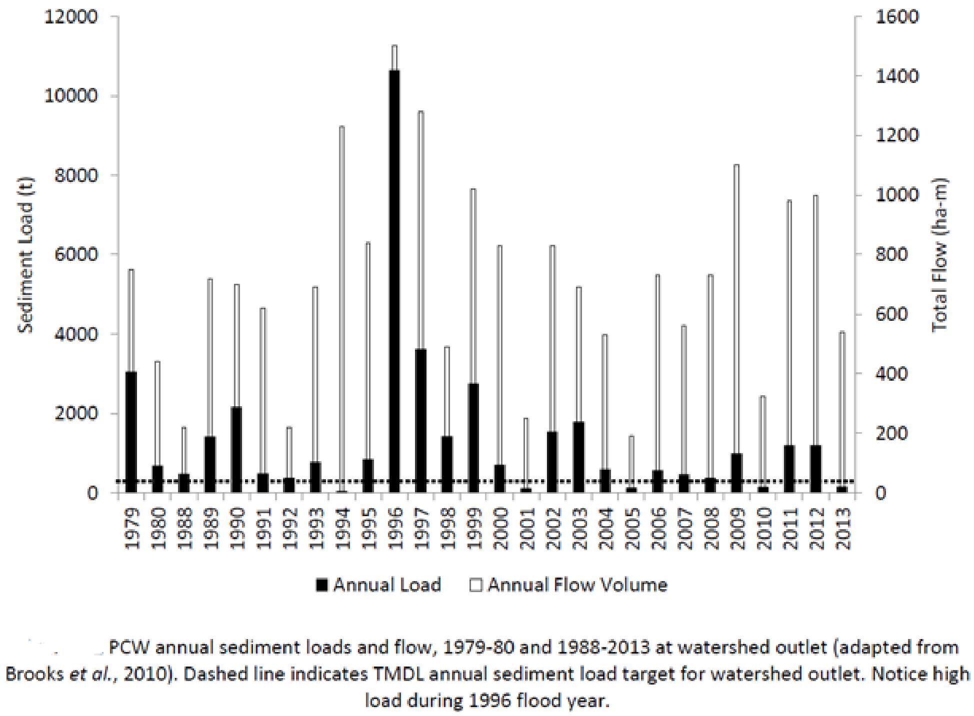
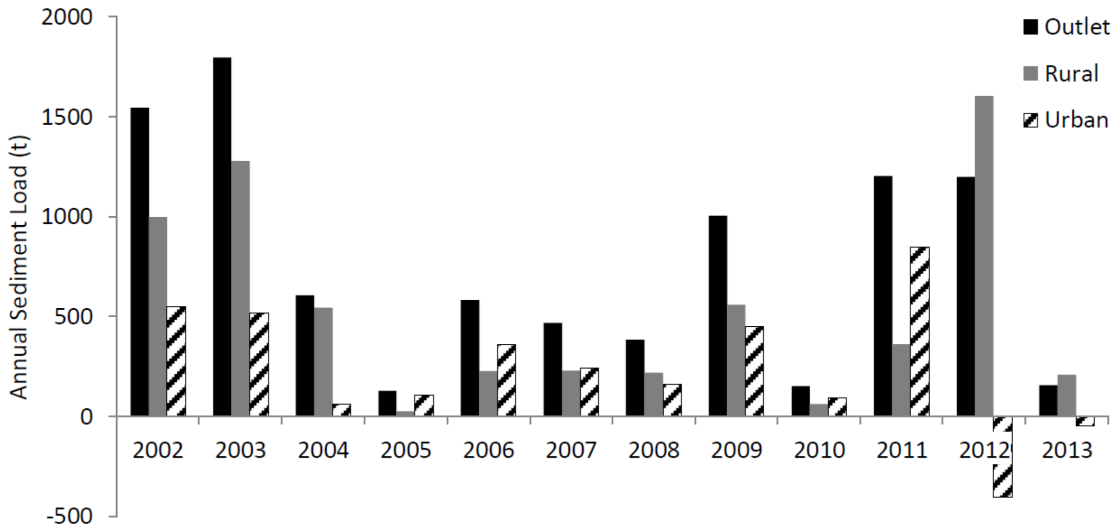


Figure 30: Paradise Creek Annual Sediment Loads and Flow 1970-80 and 1988-2013.[655]

University of Idaho M.S. student Audrey Squires examined these peak flow erosion events in the watershed for a 12 year period from 2001-2013.[656] She found that most events were "transport limited," which means the limiting factor is the flow level, not the presence of sediment. [657] Furthermore she found that "one event contributes, on average, 33% of the annual sediment load but only accounts for 2% of the time in a year."[658] Urban and rural sediment loads were compared the urban contribution "peaked in January, while the rural contribution peaked in March, coinciding with soil saturation in the watershed."[659] In years 2001- 2013 the majority of the sediment load varies from year to year between urban and agricultural

[655] Audrey Squires, *Toward Improved Water Quality* (May 2014), at 14.
[656] *Id.*
[657] Squires, at 21.
[658] Squires, at 22.
[659] Squires, at 37.

sources.[660] Figure 30 shows Paradise Creek annual sediment loads and flow from 1970-80 and 1988-2013.



Annual sediment loads measured in PCW. Black bar is total load measured at the watershed outlet. Gray bar is total load measured at rural station. Diagonally hashed bar is load attributed to urban land use by subtracting rural load from watershed outlet load. Negative value indicates deposition.

Figure 31: Annual Sediment Loads Measured in Paradise Creek.[661]

Squires recommends specifically tailoring the application of BMPs in the watershed to prevent upstream sediment sources from clogging the system.[662] Sediment loads are shown in Figure 31. She also suggested using a shorter time interval in TMDL implementation to better capture the seasonality of the events in the system.[663] Squires proposed a framework for implementing BMPs based on "three hydrologic land types" which allows for better placement of the management. Two of the land types are present in the Paradise Creek watershed.[664] The framework is for dissolved pollutants and suspended pollutants, it covers: "phosphorus,

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660 Squires, at 36.
661 Squires, at 29.
662 Squires, at 37.
663 Squires, at 38.
664 Squires, at 43.

nitrogen, pesticides and sediment."[665] This is accompanied by a literature review of studies of all three locations regarding the efficacy of BMPs. In regard to paradise Creek, Squires concluded "buffer strips were installed by willing landowners, but not necessarily where conditions were optimal, such as below steep slopes, where concentrated flow paths are present, or in areas continually inundated during the winter."[666]

University of Idaho doctoral student Rebecca Rittenburg reported on the ineffectiveness of nonpoint efforts in Paradise Creek, in her work: *Using Process-Based Hydrologic Approaches and Place-Based Education to Improve Nonpoint Source Pollution Management.*[667] Her work is an interdisciplinary effort spanning "hydrology, geomorphology, social science, and science education."[668] She concluded the significant presence of conservation efforts is disconnected from improving water quality due to "delayed and dynamic feedback from both the ineffective placement of BMPs, physical lag time inherent in the response of water bodies to BMPs, and the social lag time associated with community participation in conservation." [669]

Sediment based pollution is contingent on many factors in including hillslope, soil saturation, whether the ground is frozen, and others factors all related to infiltration. [670] Implementation of conservation tillage and the Conservation Reserve Program "facilitated increased infiltration and reduced erosion."[671] Sediments were reduced over time, but further reductions were needed.[672] This is achievable by locating BMPs on the most erodible land still

[665] Squires , at 48.
[666] Squires, at 71.
[667] Rebecca A. Rittenburg, *Using Process Based Hydrologic Approaches and Place Based Education to Improve Nonpoint Source Pollution Management* (May 2015), at iii.
[668] Rittenburg, at 8.
[669] Rittenburg, at iii.
[670] Rittenburg, at 39-40.
[671] *Id.*
[672] *Id.*

unaddressed, and to otherwise prioritize the most susceptible areas with other management efforts.[673]

Rittenburg showed a connection of hillslope hydrology and a sediment transport model to impact the placement and timing of the complex interaction between BMPs, sediment, and the stream.[674] This connection shows "an inherent disconnect between annual loads calculated from upland areas and sediment measured at the outlet of watershed, due to instream storage and transport processes of hillslope, legacy, and stream-sourced sediments."[675]

A large amount of Paradise Creek are nearing quasi-equilibrium regarding channel; other reaches are widening, especially urban reaches.[676] "Historical disturbances of land conversion from native prairie to intensive agricultural" resulted in streambeds storing large sediments in rural areas, but eventually reaching this quasi- equilibrium.[677] The urban area is responding to recent channel modification, increased impervious areas and other disturbances.[678] This is the source of high urban sediment which will only subside after recovery and connection to floodplains.[679] This understanding prompts urban focused measures, as well as measures focused on reducing introduction of sediments into the streambed, rather than altering and disturbing the loaded streambed.[680] In urban areas in stream recovery efforts should be focused on "reaches that are currently aggrading [gaining sediment] and widening to

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[673] *Id.*
[674] Rittenburg, at iii.
[675] Rittenburg, at 73.
[676] Rittenburg, at 141-143.
[677] *Id.*
[678] *Id.*
[679] *Id.*
[680] *Id.*

increase sediment retention, decrease bank erosion, and reconnect the channel with the floodplain."[681]

Rittenburg also suggests a youth program for elementary, junior and senior high school students; utilizing place based earning to increase BMP implementation and collaboration with landowners.[682] This collaboration resulted improved: community, trust, conservation, and BMP implementation.[683]

Squires, Dr. Rittenburg, Dr. Boll, and Dr. Brooks (the cohort) created a poster board for the American Geophysical union, titled: *Re-Evaluation of TMDL Development using Long-Term Monitoring Data and Modeling*.[684] First, the cohort recommended instead of daily 8AM "grab samples" three times per week should be replaced with "event-based sampling."[685] A year and a half of data during an extreme storm was substituted for 12 years of data. [686]Next, the cohort advocated replacing the current "TSS samples from top of the water column" with depth-integrated Suspended Sediment Concentration, a different metric.[687]

Another suggestion was the cohort's "Water Erosion Prediction Project model [should be used] to predict natural background loading;" however an earlier "model did not simulate saturation excess." [688] An updated Water Erosion Prediction Project model includes "saturation excess and [has] fixed coding errors to predict natural background loading, and actual loading."[689] This relates to the suggestion that "[a]nalysis did not consider stream contributions

[681] *Id.*
[682] Rittenburg , at iii.
[683] Rittenburg , at iii.
[684] Squires, et al., *Re-Evaluation of TMDL Development,* AGU fall meeting (2012).
[685] *Id.*
[686] *Id.*
[687] *Id.*
[688] *Id.*
[689] *Id.*

to sediment loads" so they should "include stream contributions. (See poster by Rittenburg et al.)"[690] Finally, the cohort felt mandated public participation "through Idaho Code 39-3601 and 39-3615 in form of Watershed Advisory Group" should be transitioned to a "[b]ottom-up public participation with focus on improving farm viability and targeting critical source areas"[691]

Discussion

The Paradise Creek TMDL and subsequent planning was significant for many reasons. While prior efforts were focused on individual concerns, such as farms, erosion, sedimentation, and land value, the TMDL was the first holistic effort in the watershed with water quality as the independent end goal. The consideration of the seven pollutants shows a more dynamic approach, yet little was known at the outset in 1997 about how this stream functions in regard to these impairments. These factors combined for large data gaps, with the 1997 TMDL containing many explicit assumptions. Despite the challenges, the many pollutants in this system need to be considered together. The TMDL for Paradise Creek was one of the first TMDLs established in Idaho due to the dire state of the water quality in 1997.

There were numerous reasons for the selection of Paradise Creek watershed as a case study. The first reason was the presence of two states within a single small watershed allows for comparison of the approaches to water quality without expanding the contextual information needed beyond the confined locality of the watershed. Secondly, was proximity, the author was residing in this location for the duration of this study. This allowed for a closer understanding of the location, in addition to ease of research. Focusing on local issues was an aspect of the appeal too; understanding one's home can be the first step to understanding the world.

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[690] *Id.*
[691] *Id.*

The presence of forested, agricultural, and urban dominated areas in Paradise Creek watershed allows for comparison of land uses in the area. Two longstanding major state research universities and large government soil conservation programs resulted in significant scholarship for the time period covered in this paper. Finally, the history of the Palouse demonstrates the agricultural origin of many of the longstanding water quality problems, which may help inform general understanding of these types of problems.

Paradise Creek does have some limitations as a case study. It is a small stream in a very unique landscape. It has a shorter history of euro-American development compared with cities in the eastern United States. The watershed is dominated by dryland agriculture which is less common than irrigated agriculture in the western United States, a significant difference which limits generalization of this case study. Paradise Creek does not have a native anadromous fish, which often trigger complex protections under the Endangered Species Act. Here, therefore, the Endangered Species Act does not apply.

Many other regions do suffer from agriculturally exacerbated soil erosion, nutrient pollution, flashy hydrology, and pollutant sourcing problems that aspects of this case study would be applicable to. Likewise generalizations regarding relationships between rural and municipal communities, non-governmental organization actions, or planning methods may or may not be relevant.

The CWA was more successful where earlier programs were not, partially due to the strong federal mandate that there at least be TMDLs in place. However TMDL implementation must include periodic adjustment to reflect new data. The current data for sediments show a disparity between TMDL load for urban lands and the actual contribution of the urban sources. Stream stored sediments and urban sources provide needs for future planning. Agricultural improvements need to continue, and programs like STEEP need continued support in addition to CWA efforts.

Nutrients focused on in the TMDL were nitrates and phosphorus. The nutrients focused on were two of the more prevalent nonpoint pollutants on Paradise Creek, there was less data at the time of the 1997 TMDL creation and thus, less understanding of their exact sources. This is the fundamental weakness of nonpoint load allotments, it can be very hard to measure diffuse effects in the field. The nutrients plan contained significant assumptions, which have proven to be insufficient for the current nitrates and phosphorus. Nitrates were problematic, but the TMDL is full of broad assumptions even when there has been more recent data for a decade.

The phosphorus TMDL does not cover in flows in the winter, when eutrophication risks are lower. With better understanding of sediment storage in Paradise Creek, a seasonal TMDL might not be the best plan, because there is not complete flushing of the system annually, like the TMDL assumed occurred in this system. Additionally the recent research suggests orthophosphates are a big problem. They could create a water quality standard targeting this specific type of phosphorus if the TMDL was updated, which would help limit one of the most detrimental types of this pollutant. The work of the current scientists shows how complicated water quality systems can be, how slow they can recover, and how mistakes in a policy can be long-lasting if not actively revised. The current problems of the nutrients TMDL should warrant a prompt revision of the 1997 TMDL. Further study is still needed, as is strong monitoring to test results of management actions.

Temperature is a prime example of how minor changes in monitoring could potentially improve data with little extra expenditures. The data set that the current TMDL was devised under only had 8am measurements, with later temperatures extrapolated by model. If one of the tests was later in the same day or during events as the scientific management cohort suggested, this source of error could potentially be eliminated for the calculations. Improving understanding of how temperature functions in Paradise Creek. Additionally, with increasing return of riparian vegetation in the form of BMP implementation, newly shaded stretches of stream could be less affected as BMPs take hold.

Pathogens discussed pose the most direct threat to human health with direct exposure of any TMDL limitation discussed. This is a timely reminder of why a clean water ethic is crucial. Likewise, Ammonia poses a direct threat to the cold water biota habitat in Paradise Creek. If a citizen cares about habitat and other broader ecological concerns, for these reasons, this pollutant is clearly important to both regulate and understand. Many native species were already lost to the Palouse during the widespread early development, recently there have been improvements.

The watershed plan showed a significant ability for this watershed to come to agreements concerning management in both states, in the watershed as a whole. To the extent these agreements can be both broadened and made more enforceable, the more effective implementation can be. A wide range of community members participated in this plan. Municipal and county governments should consider writing these plans in a manner that they could be incorporated into local land use planning. Scientists have shown the importance of the careful planning and siting of BMPs, it is important a watershed is coherently managed. PCEI and similar NGOs are another way to bridge jurisdictions, however they would be aided if the TMDL process and implementation was further integrated across jurisdictional boundaries.

The understanding of this watershed has increased greatly in the last decade. There are many aspects of the 1997 TMDL which contain false or incomplete assumptions. It was the best knowledge when the original plan was passed. Despite there being new understanding of many significant aspects of Paradise Creek, there has only been a revision of the 1997 TMDL for pathogens, specifically fecal coliform. Sedimentation and nutrients should both be updated to achieve a more accurate TMDL.

Monitoring of the Paradise Creek Basin had significant investment and momentum after initially adopting the TMDL. Since then monitoring has been taken over by the University of Idaho. Paradise Creek is lucky to have a local institution capable for stepping in, however it would be better if the watershed was comprehensively monitored in 5 year segments, like in the 2002 report. This method of monitoring is more in line with the feedback intended by the CWA, with published reports written for the general public. Funding to both the University of Idaho and Washington State is obviously crucial for building scientific understanding and ferreting out the nuances of this system. This understanding will hopefully allow for better regulation creating a cycle. Management plans are only as effective as they are accurate and timely.

Chapter 5: Conclusions and Discussion of Paradise Creek

The study of implementation of the nonpoint source provisions of the CWA in Paradise Creek has been used to explore whether it is simply the absence of mandatory regulations that explains the lack of progress in addressing nonpoint source pollution nationwide, or whether the problem lies in the details of current implementation. The historical analysis of efforts to reduce erosion from cropland, one of the primary pollutants in Paradise Creek, suggests that the appropriate solutions are highly dependent on both biophysical context and land use choices. Thus, any attempt at a nationwide regulatory program that imposes specific solutions may fail. This chapter returns to the three research questions and the conclusions and recommendations under each that can be drawn from the study of Paradise Creek. The three questions are:

1. How did Paradise Creek's historical water quality management lead to the current status of water quality in this watershed?

2. To what extent are laws and water quality management plans in Paradise Creek successful in improving water quality; how could management plans better address persistent pollution problems involving multiple pollutants?

3. Can the integration of the historical development in conjunction with the current implementation of the CWA lead to recommendations for improving water quality in Paradise Creek? Does this indicate anything about the CWA in general?

How did Paradise Creek's Historical Water Quality Management Lead to the Current Status of Water Quality in this Watershed?

Examination of the history of changes in water quality in response to different approaches to land management was done to provide insight into both the legacy effects that must be addressed today and the degree to which Paradise Creek's water quality issues are specifically tied to the unique biophysical setting and land use. The following discussion illustrates the highly contextual nature of nonpoint source pollution and thus the importance of a watershed-by-watershed tailored approach and will make three points: the regional land was highly valued by agriculture, the physical nature of the regions' hills was highly erosive, and government programs were a large part of the sediment legacy effects today.

First, the high value of this land was driven primarily by is value for agriculture. The soil was so rich on first plowing that later studies showed the early fields were as productive as the modern fields, despite the modern fields being heavily fertilized and modern farming techniques. The fact that early farmers with their basic understanding of the land and rudimentary techniques could produce almost even yields with the highly modern, large, mechanized farms of today is staggering.

While the shift to better practices has been slow and still incomplete even today, the dynamic of area growers trying to grow as much as possible and without losing their valuable soil began early. These two motivations sometimes clash, but have created a large role for farming science, technology, and specialized equipment on the Palouse, which has resulted in bigger farms due to significant capital necessary for this type of development. Tractors, pesticides and fertilizers are expensive. Large tracts of land make crop rotations easier. This cycle would repeat itself many times over in the last century in both Idaho and Washington because the value of land of for agriculture in Paradise Creek Watershed was a motivator for continued development once settlement and dryland agriculture began.

This comparable production is indicative of the extensive protective buffer provided by the deep soils in this region upon settlement. The development of the Paradise Creek Watershed and the Palouse region's development have been driven by rich soil, and subsequent agricultural growth. This points to the geography of the region as being the primary driver of growth, rather than political processes on either side of the state line. The conservation efforts only began succeeding decades after the government programs began. This is indicative of the lessening soil buffers available to farmers, and better education, which creates the desire to stop erosion, even if there are some economic limitations. Historically, it is possible that a lesser soil buffer would have spurred more concerted action to curtail erosion earlier on in the development of this region.

Second, numerous factors related to the physical nature of the watershed combined to form highly erosive land, when exacerbated by farming and other disturbances. The physical environment of Paradise Creek consists of steep slopes, rich soil, and enough rain for dryland farming; this is excellent for dryland agriculture. The rainy season comes when fields are frequently freshly disturbed. Large precipitation events channel large amounts of sediments into the system where they can remain. The steep slopes were difficult to farm at first, yet within a couple decades settlers were getting large yields at a high cost of soil loss. This is a nuanced unique system.

Third, government programs were of mixed effectiveness, persistent problems languished in the face of government efforts to curtail erosion and sedimentation of the watershed. Many early government programs didn’t put forth the best methods for erosion initially, because they lacked scientific knowledge of the physical landscape. Early programs also had differing goals, some were to help farmers economically, while others were focused on erosion. Focus and understanding of erosion was improved after many programs focused on regional problems for a while, yet local people always knew it was occurring. Beginning in the 1970s, a more focused long term effort, STEEP, was able to make gains in effectiveness with long term federal funding. STEEP's effectiveness, where other programs had failed, was due to its long term of duration, and its' focus on education, improving conservation farming capabilities, and other slow changes.

This type of planning focuses on individual landowners emphasizing their losses in production and land value resulting from erosion. STEEP has been particularly successful at getting recommendations implemented regarding conservation farming. STEEP has been used to educate the public regarding these methods, but has also entailed numerous scientists working to both understand erosion and develop high yield, low or no-till techniques that are competitive with more traditional types of farming. These comprehensive improvements were crucial to making these shifts more palatable to landowners who were also concerned about remaining viable businesses.

The current implementation of the 1997 TMDL could be the next step forward for government programs in Paradise Creek, yet many aspects of current implementation, particularly the lack of an effective feedback between monitoring and revision of management plans is dire. The CWA and its implementation plans is the most recent government program to come to the watershed. While the CWA's actions are implementation of BMPs, which is not that different from STEEP's use of BMPs to combat erosion; the CWA's holistic perspective allows for expanded management of the legacy effects to all pollutants in this system, many of which are not completely understood at this time.

To what Extent are Laws and Water Quality Management Plans in Paradise Creek Successful in Improving Water Quality; How could Management Plans better address Persistent Pollution Problems involving Multiple Pollutants?

Water quality management planning has seen mixed success in Paradise Creek. First, erosion and sediment was historically the largest problem in the watershed and was the focus of decades of programs to help prevent it. These programs have achieved many successes. Other pollutants are just beginning to be understood and managed. Second, if management plans were to comport with the CWA, then real progress could be made in Paradise Creek without major changes to national CWA, avoiding the need for more drastic, less politically feasible measures.

The headway gained against sedimentation recently is significant. The two largest reasons for the decrease in sedimentation are implementation of BMPs and STEEP's efforts regarding farming practices. The primary concern is the citing of BMPs according to the recent studies in Paradise Creek. A significant amount of BMPs have been implemented, some with effective results, mostly again for sedimentation. Despite this progress, Paradise Creek retains a large amount of sediments in the streambed, continues to have large erosive events, and still has specific areas that contribute high levels of sediments. Another important aspect is further understanding of the urban sources of pollution in the watershed that contribute large amounts of sediments. While agricultural progress has been made, there is still work to be done with urban sourced sedimentation, and the current TMDL grossly underestimates urban sediments.

Sedimentation increases stream temperature. Phosphorus, especially orthophosphate particles can travel with sediments. Pathogens can travel in this manner as well. Phosphorus and ammonia lead to plant growth in the stream and eutrophication, which affect the speed of the current and other channel characteristics. Phosphorus and nitrogen are both important factors in eutrophication. Expanding to orthophosphate specific planning along with a year-round TMDL would be a good start. More phosphorus monitoring is needed. Idaho Department of Environmental Quality should revise the 1997 Paradise Creek TMDL in regard to this new scientific literature.

The education of growers contributes largely to the successes of water quality management planning, with results in improved water quality. While STEEP's efforts were long term and concerted, and do not provide a quick fix, they reaped dividends in pollution prevention by the turn of the 21st century. Better plowing methods like no till are ways which there has been partial success. Organizations like PCEI have been crucial in community outreach, yet more could be done to assist them with grants and other support. Increasing capacity for implementing the CWA should be a goal of both the EPA and states. The majority of the CWA based management examined in this thesis are state specific plans so state capacity is an incredibly import piece of this puzzle. With the significant local resources of two state universities, interested citizenry, highly invested farmers, and PCEI, if any watershed should have enough local capacity, it should be here. A more formal network involving further organization among various levels of government would improve the process. A coherent, concerted, and focused effort to integrate planning on multiple levels is needed.

Second, even if capacity were to be increased in implementing entities, improvements in monitoring and feedback implementation would be needed if progress is to be made in this watershed. Improvements in stream management are crucial to improving lag times as well as planning gaps. Regulations should promptly correspond with the intention of law, as well as, the best scientific understanding possible. Improvements to Idaho's three step process of TMDL implementation are necessary to implement the will of Congress and for TMDLs to function as intended. The science behind TMDL implementation and related water quality monitoring is a complicated process, which is dependent on many watershed specific factors, mainly the various causes and effects of pollutants and any subsequent remediation efforts.

Better TMDL implementation involves a cyclical feedback of more sensitivity to current trends and management science. This loop would consist of; collecting data, analyzing data, revising procedures, implementation, and then data collection. Periodic review and corresponding adjustment of BMP implementation is ideal.

Third, require EPA oversight and approval of the implementation of TMDLs (step three in Idaho). Currently there is a federal requirement for the state to do management with TMDL promulgation, but the EPA is not required to approve or deny these BMPs like they do for sub-basin assessment and loading analysis. Squires and Rittenburg show the importance of the details when citing these BMPs. If EPA was to deny the insufficient plans, then states would be further motivated not to slack on implementation and monitoring. While the CWA is designed so that cooperative federalism allows for local implementation, if their state and locality is completely non active then there would still mechanisms to keep planning going. This would provide another basis for which the federal government is responsible for the entire process, and potentially another floor for what was an acceptable minimum action. It would be a logical, less severe way to instigate change, when compared to lawsuits.

If Congress considered stronger language in regards to TMDL monitoring and implementation, they could close one of the last loopholes for TMDL in-effectiveness. Water quality standards revision, designated uses and BMPs implementation would be the best targets for small amendments, and could be improved with a series of smaller shifts in regulations.

Locally and within states, other laws can be passed that force BMP implementation; in Paradise Creek both the Idaho Forest Practices Act and the City laws imposed some BMPs. Paradise Creek is lucky to have some partial mandatory implementation.

Finally, a damaged system takes time for recovery, even if current practices are not actively harming the system, many benefits are probably unseen as of yet. Paradise Creek s finally stabilizing in many reaches and sediments that are stored and later released will hopefully go down over time if less is entering the system.

Management planning in Paradise Creek has resulted in mixed successes, and a positive trajectory if you look at the long term. Within the last decade, the lack or revision of management planning in the face of new science is concerning.

Can the Integration of the Historical Development in Conjunction with the Current Implementation of the CWA lead to Recommendations for improving Water Quality in Paradise Creek? Does this indicate anything about the CWA Nationally?

Integration of historical development of Paradise Creek with current implementation of the CWA can lead to recommendations for improving water quality in the watershed. These legacy effects are discussed with focus on biophysical and social aspects. This contextualization indicates that Paradise Creek is an informative case study for understanding the interaction of historical, biophysical, and social legacy effects on other national watersheds.

Historical context allows for understanding of how these legacy effects come about and how they become entrenched in biophysical and social systems. It shows the impetus of what is happening in area on a long term scale, by furthering planning to address an area of lag or other types of planning gaps that inhibit proper implementation of best science.

Biophysically a functional monitoring and feedback cycle is needed. Buffer layers that were once present are gone or disappearing. Yields haven't increased from the early days, merely have held steady despite the improved farming technology. If farmers understand the biophysical system, there is increased motivation to prevent sedimentation. Education is a slow solution, yet it is necessary for lasting change as shown by STEEP. This type of stable, consistent, improvement requires for a longer planning horizon, but must be religiously adhered to if the CWA is to see the success STEEP has, since these systems are slow to change. History illustrates uncertainty and lags in biophysical planning, so when problems or success is not forthcoming, new approaches are needed. If current understanding isn't implemented it limits this process, which is another reason to have the current scientific understanding implemented as quickly as possible.

Socially there are many lags in this system as well, many aspects of Paradise Creek implementation relies on a bottom up approach to improving water quality. For example, adoption of better practices occurs at the level of the individual grower. When relying on local implementation, local capacity is tested. Whether it is the grower who decides to try new conservation farming methods on his land after seeing a STEEP presentation or the community member volunteering on their local WAG, many aspects of local watershed management rely on the impetus for positive change being from the bottom up. Improvements in coordination amongst bottom up efforts could help water quality improve in this watershed, by more effectively placing BMPs and other localized management, as recommended by Squires and Rittenburg.

Educational efforts could reach wider audiences with better coordination, even if minds are slow to change from traditional farming. While many aspects of law are by nature top down, the cooperative federalist aspects of the CWA dictate a strong local and state role in this process, which is an advantage to adaptability, but limited by capacity.

Pollutants flowing downstream can become more concentrated, this is one example of why federal law is the appropriate venue for the clean water protections even if local actors are important. The history of forum shopping between the states under the 1948 clean water act buttresses these concerns. Paradise Creek is a part of the water basin ofone major U.S. river, the Columbia, and its largest tributary, the Snake.   Watershed activates need to be evaluated according to their impact on the system as a whole as well as within the locality of the watershed. Since government water knowledge is centralized at the state level, the States are needed for direct administration of state law and the CWA. Local groups will have the most specialized “local” knowledge. Due to the needs for any water quality provision to be tailored to the unique characteristics of the watershed, a cooperative relationship between locals, state governments, and federal government is necessary.

Paradise Creek is an informative case study for understanding the interaction of historical, biophysical, and social legacy effects on other national watersheds. There has been little change to the statutory structure at the federal level since 1972. The top down aspects of federal law show a necessary and proper role of the federal government. Problems often go unsolved without strong declarations of goals, deadlines, and policy. By setting a floor for national water quality standards, Congress protected a widespread valuable resource, which flows across state lines naturally in rivers and streams. Maintaining a healthy balance between the top down and bottom up aspects of this cooperative-federalism based system is crucial.

Softer solutions seem appealing when the cost and acrimony of lawsuits are considered. Paradise Creek has a substantial local interest in the cleaner water; from growers who want to do right by their lands, to PCEI and other environmental groups which will also hold true for many watershed nationally. These groups have accomplished considerable headway in the years immediately following the TMDL implementation, this suggests lawsuits would not be the best course of action in this watershed.

Cooperative federalism is double edged sword within the CWA, due to the role of constitutional authority and the scope of the job of monitoring water quality. Each level of government and nongovernmental organizations all have niches in water quality regime that they can fill best. The risks of such a decentralized system are made clear by the history; nothing gets done and no one is responsible for the lack of action, initially on TMDL implementation, now on TMDL revision.

Paradise Creek's historical water quality developed into the current status of water quality by developing the land in a rapid manner, while simultaneously trying to prevent erosion. Early on development had the clear upper hand, yet currently a more balanced approach has been established. Laws and water quality management plans in Paradise Creek have been successful in improving water quality but management plans could better address persistent problems of the multiple pollutants, lags and gaps. The integration of the historical development in conjunction with the current planning leads to better recommendations for improving water quality in Paradise Creek and nationally by suggesting many solutions to different aspects of a large and complicated issue of water quality.

Reference List

This list of references is designed to help people unfamiliar with Bluebook citation style and common short cites. It is arranged alphabetically: by first authors' last name, or first parties' last name for legal cases. If neither of these are available, then by title. This list also contains other legal abbreviations used in the footnotes, by first letter of the abbreviation. URLs are omitted on this list, but are located in the corresponding footnote.

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